

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

A389.9
Ag 85
cop. 2

Administratively Confidential
(Not to be Quoted or Copied)

PROGRESS REPORT ON RESEARCH AND RELATED SERVICE
APPLICABLE TO
FOOD AND NUTRITION

Including Work in United States Department of Agriculture
and Cooperative Studies with
The State Experiment Stations

* * *

This Progress Report is a "tool" for: (1) Advisory Committee use in formulation of recommendations in regard to present and future programs; (2) Administrative use in program development, coordination and evaluation. The material in this Report is not for publication. The report includes research findings that have already been released. When mention is made of these findings, the publication containing the public release is also cited. Any reference to published findings should mention the publication in which the release was made, not this Progress Report. Included also are many tentative findings that have not been sufficiently tested for public release. When results are ready for release, the information will be made available through established channels.

For the reasons given, copies of the Report are available only to research administrators and workers directly concerned with the development and conduct of the program and to advisory committee members. Those receiving it are asked to observe strictly the limitation: "Administratively Confidential -- (Not to be Quoted or Copied)."

UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D. C.
September 1956

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

MAR 6 1969

CURRENT SERIAL RECORDS

FUNCTIONS OF ADVISORY COMMITTEES

The Food and Nutrition Research Advisory Committee is one of a number of committees authorized by Congress in 1946 to advise the Department of Agriculture with respect to specific research and service programs.

The committees have been asked to consider all of the research and marketing service work of the Department in their respective fields. This is in recognition of the value the Department places upon the advice and counsel received and is in accord with suggestions of Congressional committee members who are directly concerned with the work.

These committees are performing an important function in advising with respect to the development of the Department's research and marketing service programs. However, it is recognized by members of Congress, committee members, and the Department that the implementing and administering of these programs are the responsibility of the Department.

The functions of the advisory committeemen include:

1. Acquainting themselves with the problems of consumers, producers, all segments of the industry and of other groups, and presenting them for committee consideration.
 2. Reviewing and evaluating the current research and marketing service programs of the Department, including work under way at Federal laboratories and field stations.
 3. Recommending adjustments in the Department's program, including priorities for new work and expansion of work under way.
 4. Developing a better understanding of the nature and value of the agricultural research program, explaining it to interested persons, groups and organizations and encouraging the wider and more rapid application of the findings of research.
-

COOPERATION

Much of the research on food and nutrition covered in this report is conducted in cooperation between agencies of the United States Department of Agriculture and the State Experiment Stations. The studies find their origin in problems of producers, processors, distributors and consumers, and representatives of these groups frequently participate in the cooperation. Cooperative programs are jointly planned and conducted in a manner to make full use of the personnel and resources of each participating group with the minimum of duplicative effort. The results of cooperative research are jointly prepared in the form of uniform recommendations.

* * *

SYMBOLS USED TO DESIGNATE REPORTING AGENCIES

ARS -- Agricultural Research Service

- ADP - Animal Disease and Parasite Research Branch
- DH - Dairy Husbandry Research Branch
- ENT - Entomology Research Branch
- EU - Eastern Utilization Research Branch
- FC - Field Crops Research Branch
- HC - Horticultural Research Branch
- HHE - Household Economics Research Branch
- HN - Human Nutrition Research Branch
- SWC - Soil and Water Conservation Research Branch
- WU - Western Utilization Research Branch

AMS -- Agricultural Marketing Service

- BS - Biological Sciences Branch
- FD - Food Distribution Division
- MD - Market Development Branch
- MCC - Market Organization and Costs Branch
- SHR - Statistical and Historical Research Branch

FES -- Federal Extension Service

TABLE OF CONTENTS

	<u>Pages</u>
<u>I. FOOD COMPOSITION IN RELATION TO NUTRITIVE VALUE</u>	
A. PROGRESS ON WORK UNDER WAY	1--3
1. Amino Acids in Bread	1
2. Accessory Amino Acids	1
3. Proximate Composition of Foods	1
4. Minerals in Foods	2
5. Progress in Analytical Methods for Food Assays	2
6. Breeding Potatoes for High Vitamin C Content	3
7. Effect of Age on the Amino Acid Composition of Leafy Greens	3
8. Effects of Micronutrient Element Nutrition on Amino Acid Composition of Plants	4
9. New Sulfur Amino Acids in Plants	4
10. Effect of Environment and Soils on the Nutritive Value of Turnip Greens as Measured by Growth of Rats	4
11. Effect of Environment and Soils on the Nutritive Value of Alfalfa as Measured by Growth of the Rabbit	5
12. Effects of Environment and Soils on Nutritive Value of Timothy as Measured by Growth of Rabbits	5
13. Effect of Vitamin B ₁₂ on Protein Metabolism	5
14. Vitamin B ₁₂ Potency of Cheese and Other Dairy Pro- ducts	6
15. Relative Nutritive Properties of Butterfat and Vegetable Fats	6
Publications	7--8
B. PROPOSALS FOR COMMITTEE CONSIDERATION	9--10
<u>II. HUMAN NUTRITION</u>	
A. PROGRESS ON WORK UNDER WAY	11--16
1. Diet and Physical Impairment	11
2. Factors Affecting Requirements for Amino Acids	11
3. Availability of Nutrients from Foods	11
4. Fatty Acid Requirements	12
5. Metabolic Response of Young Women to a Reference Diet	12
6. Metabolic Patterns of 7-9 Year Old Girls	12
7. Basal Metabolic Rates in Children	13
8. Heights and Weights of U. S. Population Groups	13
Publications	13--16
B. PROPOSALS FOR COMMITTEE CONSIDERATION	17--18

III. FOOD QUALITY AND HOUSEHOLD USE

A. PROGRESS ON WORK UNDER WAY	19--30
1. Breeding and Quality Evaluation - Cereal Crops	19
2. Effect on Diethylstilbestrol Supplementation on Quality of Beef	20
3. Inheritance of Tenderness	20
4. Quality of Pork from Hogs of High and Low Degree of Fatness	21
5. Quality of Lamb Meat Affected by Breeding, Feeding and Management	21
6. Palatability of Poultry Affected by Diet	22
7. Predetermining the Cooking Quality of Rice	22
8. Quality of Pressure-Cooked Potatoes	23
9. Fruit Jellies with Added Pectin	23
10. Measurement of Food Quality	23
11. Changes in Egg Quality During Distribution	25
12. Effects of Pesticides on Food Quality	25
Publications	28--30
B. PROPOSALS FOR COMMITTEE CONSIDERATION	31--35

IV. FOOD CONSUMPTION AND DIETARY LEVELS

A. PROGRESS ON WORK UNDER WAY	36--54
1. National Food Supply	36
a. Trends in Food Consumption	36
b. Consumption of Processed Foods	36
c. Studies for Food Stamp Plan	36
d. Marketing Studies on Economic Loss and Waste	36
2. Household Food Consumption	37
a. 1955 Food Consumption Survey	37
b. Food Consumption and Dietary Levels of Rural Families	39
c. Food Consumption and Losses in Four Institutions	41
3. Diet Appraisal	42
a. Basic Data for Food and Nutrition Program	42
b. Facts for Consumer Education	43
c. Composition and Nutritive Value of Foods	43
d. Contribution to Food and Nutrition Programs	44



	<u>Pages</u>
IV. <u>FOOD CONSUMPTION AND DIETARY LEVELS (Continued)</u>	
4. Food Purchases and Preferences	
a. Industrial Feeding Facilities	45
b. Food Marketing Margins and Costs	46
c. Patterns in Meat Distribution	46
d. Institutional Market Potential for Oilseed Products	46
e. Effects of Coupons and "Special Offers"	47
f. School Milk Program Evaluations	47
g. School Lunch Program Evaluations	48
h. Household Purchases of Dairy Products	48
i. Consumer Purchases of Fruits and Juices	48
j. Consumer Acceptance and Preference Studies	49
B. PROPOSALS FOR COMMITTEE CONSIDERATION	55--58
V. <u>RESEARCH AND EDUCATIONAL WORK ON BROAD OR GENERAL WELFARE PROBLEMS</u>	
A. PROGRESS ON WORK UNDER WAY	
1. Food Distribution Division - AMS	59
a. National School Lunch Program	59
b. Special Milk Program	59
c. Direct Distribution	60
2. Federal Extension Service Food and Nutrition Program	60
PROPOSALS FOR COMMITTEE CONSIDERATION - TOTAL LISTING	62

I. FOOD COMPOSITION IN RELATION TO NUTRITIVE VALUE

A. PROGRESS ON WORK UNDER WAY

1. Amino Acids in Bread

HN

In laboratory assays to obtain data on amino acids in a variety of foods, wheat and bread at its various stages of production have been investigated intensively. The bread samples analyzed were baked from a "national" sample of wheat using a standard formula in the test laboratories of the Grain Branch of AMS, and replicated the second year. The wheat and fractions of wheat, the flour and other ingredients were analyzed separately, and the combined ingredients were analyzed in the dough unfermented, dough fermented, and in the bread after baking. Recombination of values for wheat fractions vs. whole wheat, and of bread ingredients vs. fresh dough proved to be excellent checks on validity of analytical procedures. Slight to moderate losses in amino acids were traced to baking per se, none to the dough processing. In both series of experiments, losses of around 20 percent were found for lysine and tyrosine; and around 10 percent for leucine, methionine, and phenylalanine. For all other amino acids, the losses were slight or negligible, but only one set of values in 22 did not show some measure of loss.

Plans: Work completed and a technical paper prepared for publication.

2. Accessory Amino Acids

HN

In addition to assaying some 40 foods for ten "essential" amino acids, and for cystine and tyrosine (reported in 1954), their content of aspartic acid, glutamic acid, glycine and proline, have been determined. Values will be sought for alanine and serine in the same foods to complete the information on the so-called "non-essential" amino acids; some of these are recognized to have accessory values in nutrition.

Plans: The analyses are planned for completion in 1957; reports of analytical data and methodology will be prepared for publication.

3. Proximate Composition of Foods

HN

For some time questions have been raised in connection with diet appraisal about the probable validity of applying available food composition and energy value data to present day foods. To help supply current information, all food samples used for any laboratory purpose are being analyzed to determine proximate composition. Analyses have now been completed in 168 samples from pantothenic acid assays, and on a variety of foods used in other experiments, with particular attention to meats. The need for extending such analyses to a wide variety of pork products is indicated by the

two-fold differences in fat content found in several analyses of roast pork, prepared from different brands and market samples. The fat content of pork as purchased tended to be higher than in current food composition tables, while all sausages analyzed were higher in fat than is shown in current tables.

Plans: Intensive investigations on proximate composition of livestock products have been made possible through increased appropriations for such work. Amino acids, minerals and 6 B-vitamins will be determined on selected samples from animals differing in age and feed management. Work will be initiated on lamb and pork, for which data are known to be inadequate, and on differences related to market quality and to lean as compared with fat types.

4. Minerals in Foods

HN

During the year market samples of 10 vegetables -- beet, cabbage, carrot, celery, kale, lettuce, onion, snapbean, spinach and tomato -- have been assayed for nine mineral elements -- calcium, phosphorus, magnesium, sodium, potassium, iron, copper, manganese and aluminium -- in connection with standardization of analytical procedures. The analysis will now be extended to a wider geographic sampling of these and other vegetables, to determine whether mineral composition differs much from that reported for foods analyzed 50 years or more ago. In these ten samples of vegetables, iron and calcium values were lower than the older data except lettuce and kale which tended to be higher, but values for phosphorus, magnesium and sodium deviate variously. No conclusions can be drawn until data are available from a wider sampling of these vegetables.

Plans: To be continued at about the same level.

5. Progress in Analytical Methods for Food Assays

HN

During the year, considerable progress has been made in developing, improving, or standardizing several analytical procedures.

- (a) Vitamin B₆. In the vitamin B₆ assays, chromatographic separation of the components of the vitamin combined with a microbiological assay, using a yeast as the response organism, has been developed into a standardized procedure. Extraction of some food samples using a 15 minute autoclaving plus an enzyme treatment, gave results comparable to the customary five-hour autoclaving.
- (b) Vitamin B₁₂. Work has proceeded on standardization of procedures to insure reproducibility and accuracy. In assay of a few foods, comparable data have been obtained using either of two types of organisms, a protozoa and a lactobacillus. The protozoa is reported to have specific requirement for vitamin B₁₂; while the lactobacillus may utilize related

compounds including the pseudo-vitamin. Both organisms will be used in analysis of typical foods in early work, and throughout all assays if inconsistent findings justify this type of replication. Bioassays will be used for further validation of the method.

- (c) Fat. Improved procedures for extraction of fat from foods high in carbohydrate will make possible more precise values on fat content of foods. From acid-hydrolyzed samples, unrealistically high values had been obtained for fat, due to ether extraction of furfural derivatives and sugars.
- (d) Crude Fiber. An improved enzyme method for determination of crude fiber has been standardized with respect to pretreatment of samples containing starches, and to conditions of time, temperatures and concentration for enzyme solubilization of the starches. Some improvements in the method of correcting for residual protein are being sought before application of assay to a variety of foods.

Plans: Work along these lines will be continued at about the same level.

6. Breeding Potatoes for High Vitamin C (Ascorbic Acid) Content SWC

The study of potato varieties has continued, with the objective of finding breeding material which will transmit high vitamin C content to the progeny. It was previously found that two selections have nearly doubled the vitamin content of the best commercial varieties. Seedlings from these parents have had low fertility and work is continuing to obtain progeny from these selections which have demonstrated ability to transmit high ascorbic acid content to their progeny. Tubers from two crosses show considerable promise.

Plans: To be continued at present level.

7. The Effect of Age on the Amino Acid Composition of Leafy Greens SWC

In connection with the study of the effect of the micronutrient elements on the amino acid content of turnip greens, a study was conducted on the effects of leaf age on nitrogen content and amino acid composition. It was not surprising to find that both the non-protein and protein contents of young leaves was much higher than in old leaves, but the extent of the increase in level was unexpected. In the non-protein amino acid fraction, aspartic acid, glutamic acid, glycine, serine, and threonine were much higher in young leaves, while alanine, methionine, proline, and tyrosine were much higher in older leaves.

Plans: To be continued at present level.

8. The Effects of Micronutrient Element Nutrition on the Amino Acid Composition of Plants

SWC

As a beginning in this study, the effects of manganese deficiency on the amino acid content of Chlorella have been considered. The composition of the protein fraction has been found to be unaffected by manganese deficiency or nitrogen source. This agrees with previous work, in which it was shown that protein composition of turnips grown under potassium, magnesium, and calcium deficient conditions was essentially no different from that of normal plants. Protein composition appears to be under genetic control. The nonprotein amino acids are strikingly affected by manganese deficiency. With nitrate as nitrogen source, glutamic acid decreases strikingly while alanine, arginine, and proline increase in manganese deficient plants. Under ammonium nutrition, manganese deficiency produces the same effects on glutamic acid and arginine, but alanine and proline both decrease. The other amino acids are not significantly affected by manganese deficiency. These results are in line with the known fact that manganese is essential in arginine breakdown by the enzyme arginase. In addition, these results implicate manganese in nitrate reduction and ammonia utilization.

Plans: To be continued at present level.

9. New Sulfur Amino Acids in Plants

SWC

It was previously reported that a new sulfur amino acid, methyl cysteine sulfoxide, had been isolated from turnips. This compound has a characteristic turnip odor and may account for much of the turnip smell. Further work has shown that methyl cysteine sulfoxide occurs in other crucifers such as broccoli, cauliflower, mustard, radish, etc. and is present in some in even higher amounts than in the turnip. Recent experiments have shown that this sulfoxide probably arises by oxidation of methyl cysteine. No evidence for methyl cysteine in turnips or other crucifers tested has been forthcoming. Methyl cysteine has, however, been isolated from snap bean seeds. Neither methyl cysteine nor its sulfoxide can substitute for methionine or cysteine in nutrition of microorganisms. Methyl cysteine sulfoxide interferes with aspartic acid utilization by microorganisms.

Plans: To be continued at present level.

10. The Effect of Environment and Soils on the Nutritive Value of Turnip Greens as Measured by Growth of Rats

SWC

Additional evidence has been obtained on the nature of the nutritional differences in turnip greens from two locations in Georgia. Chick assays and microbiological assays with Ochromonas malhamensis and Lactobacillus leichmannii had shown a significantly higher content of a "vitamin B₁₂-like" substance in the better turnip greens from Blairsville. Tests by the procedures of paper electrophoresis and paper chromatography have strongly indicated that this is true

vitamin B₁₂. Since there is no evidence that higher plants form vitamin B₁₂, consideration was given to the possibility that the vitamin B₁₂ may have come from the soil. Analysis of the soils from the two locations in Georgia has not revealed any significant difference in vitamin B₁₂ content.

Plans: To be continued at present level.

11. The Effect of Environment and Soils on the Nutritive Value of Alfalfa as Measured by Growth of the Rabbit

SWC

Alfalfa has been grown in four locations -- Ithaca, New York; Brawley, California; Lincoln, Nebraska; and Raleigh, North Carolina -- and the hay from these locations fed to rabbits to test the nutritive quality by growth. Experiments were conducted on each of two cuttings for two years. In all tests the alfalfa from California gave greater weight gains and feed efficiency than alfalfa from New York and Nebraska. One year the North Carolina alfalfa was as good as the California alfalfa. The analyses are not complete enough to explain the superiority of the California alfalfa on the basis of composition.

Plans: To be continued at present level.

12. The Effects of Environment and Soils on the Nutritive Value of Timothy as Measured by Growth of Rabbits

SWC

Studies at the New Hampshire Experiment Station have shown that timothy, brome grass, and ladino clover grown on intensively fertilized soils and fed to cows give poor growth, rough coats, anemia, sagging of the spinal column behind the shoulders, loss of tips of ears, and broken bones. Mineral analyses of these forages have shown low contents of iron, cobalt, copper, magnesium, and manganese and normal contents of calcium and phosphorus. Supplements of calcium phosphate to the diet improved the spinal sag and strength of bones. Because of the complex nature of the problem and greater difficulty in working with cows, work was initiated with rabbits.

Timothy was used as the main constituent of the diet (75 per cent). The remaining components were wheat gluten, fat, cerelose, salt (NaCl), and vitamins A and D. The rabbits suffered poor growth, mild anemia, enlarged thyroid glands, and low breaking strength of the leg bones. Five per cent alfalfa, ash from the same amount of alfalfa, and iodine all reduced the thyroid size and increased the breaking strength of bones. The anemia and poor growth were still evident and their causes are still unknown.

Plans: To be continued at present level.

13. Effect of Vitamin B₁₂ on Protein Metabolism

DH

Previous work in this laboratory has shown that when a vitamin B₁₂-deficient ration containing 25% protein was fed to B₁₂-deficient

weanling rats, their subsequent four week weight gains were about 50% of normal. An increase in the protein level of this ration to 45% led to weight gains that were only about 25% of normal and a further increase to 65% led to still further reduced growth and, in many cases, to early death. In contrast, when these rations were supplemented with a maximally effective level of vitamin B₁₂, the growth obtained was normal or nearly normal at the 25% and 45% protein levels and about 85% of normal at the 65% protein level.

It is not known whether this growth depression, associated with increased protein level and vitamin B₁₂ deficiency, was due to an increase in protein level as such, regardless of the particular amino acids involved, or whether it was due to an increase in the level of one or more individual amino acids or a combination of certain ones. Preliminary tests have been carried out in an effort to clarify this point. A basal ration containing 20% B₁₂-deficient casein and 5% yeast protein has been used. Most of the amino acids present in casein have now been tested by adding them individually to this basal ration in amounts equivalent to their content in 40% casein. Of the ones tested, only threonine, serine, valine and aspartic acid had a growth-depressing effect equivalent to that obtained with the 65% protein ration. The interpretation of these results is complicated, however, by such factors as the presence of the d-isomers in some of the amino acids tested and the question of possible amino acid imbalance.

Plans: To continue the tests as described above to try to ascertain the effects of the complicating factors involved on the results obtained. To carry out further tests along the same general lines as indicated from results of studies currently in progress.

14. Vitamin B₁₂ Potency of Cheese and Other Dairy Products

DH

Comparative rat and microbiological (*L. leichmannii*) assays for vitamin B₁₂ have been made on a number of different samples of Cheddar, Swiss and cottage cheese and other dairy products. This work has now been completed and the results published.

15. Relative Nutritive Properties of Butterfat and Vegetable Fats

DH

It has previously been reported that when sulfathalidine was included in a purified ration containing 20% fat, weanling rats gained weight more rapidly when the dietary fat consisted of butterfat than when it was composed of corn oil. Further studies along these lines have been carried out.

Some evidence was obtained to indicate that the addition to the basal ration of certain crude food materials would eliminate the growth difference obtained between rats fed corn oil and those fed butterfat but more work is needed before definite conclusions can be drawn. Adding a butter flavor (diacetyl) to the corn oil ration failed to increase the growth rate of rats fed this diet.

Increasing the stress on the animal by including iodinated casein in the ration failed to increase the difference in growth obtained between rats fed butterfat and those fed corn oil. In fact under these conditions, the rats fed corn oil usually grew faster, possibly due to an increased requirement for the essential fatty acids under stress conditions.

Various fat levels in the basal ration were tested. The growth differences between rats fed butterfat and those fed corn oil which were found at a 23% fat level disappeared when the fat level was lowered to 10%, while, at a 20% fat level, differences were found in some experiments but not in others.

In preliminary experiments, no marked differences were observed in the various phases of reproduction and lactation between small groups of rats reared to maturity on rations containing the various fats either with or without sulfathalidine.

Plans: Continue studies on the nature of this growth effect and make an effort to determine what factor or factors may be responsible for it.

Publications

HN

"A Microbiological Method for Determination of Cystine in Foods," Millard J. Horn and Amos E. Blum, Cereal Chemistry 33, 13, 1956.

"Cystine, Tyrosine and Essential Amino Acid Contents of Selected Foods," Cecile H. Edwards, Lolla P. Carter, and Charlotte E. Outland, Journal Agr. and Food Chem. 3, 1955.

"Fatty Acid Composition, and Oxidative Deterioration During Storage of Fats in Cuts of Beef, Lamb, Pork, and Turkey," O. S. Privett, F. J. Pusch, and W. O. Lundberg, Food Technology 9, 347-351, 1955.

"Boneless Beef: Raw, Cooked, Served ... Results of Analysis for Moisture, Protein, Fat and Ash." E. W. Toepfer, C. S. Pritchett, and E. M. Hewston, USDA Tech. Bulletin No. 1137, 1955.

"The Use of Pandanus Fruit as Food in Micronesia", Carey D. Miller, Mary Murai and Florence Pen, Pacific Science, Vol. X, No. 1, Jan. 1956.

Publications

SWC

"The Isolation of L (-/-)S-methyl Cysteine Sulfoxide from Turnip Roots (Brassica rapa)," Clayton J. Morris and John F. Thompson, Chemistry and Industry, p. 951, 1955.

"The Identification of L(-/-)S-methyl Cysteine Sulfoxide in Plants," Clayton J. Morris and John F. Thompson, J. Am. Chem. Soc. 78: 1605-1608, 1956.

Publications

DH

"Vitamin B₁₂ Content of Milk and Milk Products as Determined by Rat Assay," A. M. Hartman, L. P. Dryden and G. H. Riedel. J. Nutrition, 59: 77 (1956).

"Comparative Assay for Vitamin B₁₂ in Certain Milk Products by Various Rat Growth Methods," L. B. Dryden, G. H. Riedel and A. M. Hartman. J. Nutrition 59: 89 (1956).

"Vitamin B₁₂ Content of Milk and Milk Products." A. M. Hartman, L. P. Dryden, L. A. Moore and R. E. Hodgson. Proceedings, XIVth International Dairy Congress (Rome, 1956). In press.

"Vitamin B₁₂ Potency of Cheddar, Swiss and Cottage Cheese." A. M. Hartman, L. P. Dryden and R. E. Hargrove. Food Research (1956). In press.

"Experiments on the Comparative Nutritive Value of Butter and Vegetable Fats." L. P. Dryden, J. B. Foley, P. F. Gleis and A. M. Hartman. J. Nutrition, 50: 189 (1956).

"Reproduction and Lactation of Rats Fed Glyceryl Trilaurate-containing Diets." L. P. Dryden, P. F. Gleis and A. M. Hartman. J. Nutrition, 50: 335 (1956).

"The Comparative Nutritive Value of Butter and Vegetable Fats." L. P. Dryden, A. M. Hartman, P. F. Gleis, L. A. Moore and R. E. Hodgson. Proceedings, XIVth International Dairy Congress (Rome, 1956). In press.

B. PROPOSALS FOR COMMITTEE CONSIDERATION ON
I. FOOD COMPOSITION IN RELATION TO NUTRITIVE VALUE

(Order of listing has no priority significance)

- A. Fatty Acids and Other Lipids in Foods -- Expand research to obtain more comprehensive data on fatty acids and other lipid fractions in foods.

Compilations of data available in the literature and results from recent contract research leave much to be desired in figures for estimating the content of "essential" fatty acids in foods, and afford very little or no information on the other fatty acids or the other lipid fractions. Information on composition of fats is inadequate for a reasonable appraisal of the lipid value of foods, or for interpreting many research findings on the biological effects of fats. Research should be undertaken to obtain a more complete characterization of the lipid constituents of foods, including the long and short chain as well as the saturated and unsaturated fatty acids, and also cholesterol, phospholipids and other lipids of nutritional importance. Data are needed on the variations in fatty acid content of fats of animal origins, particularly those associated with common differences in animal ration. Analytical techniques should be improved and more rapid assay methods developed to facilitate accumulation of data keeping pace with research advances in understanding the role of fats in nutrition.

- B. Carbohydrates in Foods -- Initiate laboratory analyses on carbohydrates in foods to replace inadequate or obsolete data likely to give erroneous results in diet planning and appraisal.

Present tables of food composition carry values for carbohydrate by difference between total and other constituents of proximate composition -- protein, fat, moisture, and ash. Values from direct assays have not been feasible because of inadequate analytical methods. For some time clinicians, including those responsible for diets of diabetics and obese persons, have wanted better values as a basis for diet control. General nutrition interest in the kind and amount of carbohydrates in foods is increasing also because of their interrelationship with other nutrients, including amino acids. Work should be initiated to determine systematically the quantities of different forms of carbohydrates -- sugars, starches, cellulose, and pentosans -- in common foods, in order that the values may be available for use in the current revision of tables of food composition.

- C. Organic Acids in Foods -- Initiate laboratory analyses to determine the kinds and quantities of various organic acids in fruits and vegetables.

Present tables of food composition treat all organic acids as carbohydrates in reckoning caloric values, but some are not metabolized

for energy production and some affect the utilization of calcium and other nutrients. Data on the quantitative distribution of the predominating organic acids in foods are needed to improve the accuracy of values for calories and other nutrients, and to provide clinicians with basic information needed in prescribing diets for some metabolic disorders. (This work can not be completed in time for the current revision of food composition tables.)

- D. Nutritive Value of Poultry Products -- Expand research to provide improved data on the nutritive value of poultry in forms as commonly processed for the table.

Poultry is being produced by various new growth-acceleration methods, is being processed differently for the market, and is being sold in a wider variety of cooked products than ever before. Present data on nutritive value are inadequate, and basic information on size of birds and yields of meat from the whole or different parts of birds are not available for adapting such data as are available. New data should include edible yield, calorie, protein and B-vitamin values, of poultry products as marketed and as eaten. In view of the increasing consumption of poultry products, analyses should be undertaken to obtain representative figures on the nutritive value of entire carcasses and for component parts, for principal kinds, age classes of birds as marketed, raw and ready-to-serve in commonly processed forms.

II. HUMAN NUTRITION

A. PROGRESS ON WORK UNDER WAY

1. Diet and Physical Impairment

HN

The long-term study of the relation of diet to premature physical impairment in laboratory animals has resolved itself into problems of balance among nutrients, and data are being summarized for publication. Data to be included in the publication include (a) analytical data for proximate composition, and computed data for amino acids, fatty acids, minerals and the known vitamins for the diets used; (b) biochemical data including blood cholesterol, electrophoretic analyses and composition of liver and kidneys; (c) physical data on feed consumption, size of animals and survival periods; and (d) autopsy data on size and other gross changes and histological conditions of organs.

Plans: To publish findings, as indicated above.

2. Factors Affecting Requirements for Amino Acids

HN

Experimental research using laboratory animals is indicating that a number of factors may affect the requirements for amino acids. The amounts and kinds of other nutrients in the diet may determine whether the calories eaten are converted to lean tissues or to fat depots in various parts of the body. Last year it was reported that with restricted protein intake, diets containing the starches of corn, rice, or wheat, tend to lessen the amount of liver fat, deposited, as compared to a diet containing sucrose as the sole carbohydrate. Threonine has been found to be more effective than any other amino acid or carbohydrate tested in preventing the accumulation of liver fat under these conditions. More carcass fat, but the same protein content, resulted when penicillin was fed in the presence of corn starch than when fed with sugar. These studies are showing that data on weight gains and from nitrogen balances must be accompanied by data on tissue or carcass composition for sound interpretations of research results.

Plans: This work is being redirected to use intact food protein in place of amino acid formulas.

3. Availability of Nutrients from Foods

HN

Considerable progress has been made through contract research toward developing an improved method for measuring the nutritional availability of energy value, protein, and amino acids in foods. This research, using human subjects, indicates that analyses of feces and urine for nutrients in addition to the usual nitrogen, fat and carbohydrate determinations are needed for evaluation of data on digestibility of foods as obtained by classical procedures, and in order to help explain conflicts in published data on biological values of proteins.

Plans: The findings will be prepared for publication.

4. Fatty Acid Requirements

HN

Continued investigations of requirements for unsaturated fatty acids by children have indicated that changes in blood serum levels of unsaturated fatty acids are related to the form in which linoleic acid is given, as well as to the intake level. When added to a diet low in fat, changes of comparable magnitude in blood levels were obtained from supplementing with 1 percent of the calories as triglyceride (trilinolein) or with 3 percent of the calories in the form of the methylester of linoleic acid.

Plans: These investigations will continue at about the same level until the contract work is completed.

5. Metabolic Response of Young Women to a Reference Diet

HN

Contract research at four locations is determining individual variability of young women in their response to a reference diet containing moderate levels of nutrients, under uniform conditions of dietary components (same supply lot), management of feeding and collections, and analytical methods. All stations are measuring the response to the reference diet without change for 15 days, followed at two locations, north and south, by variation in levels of magnesium intake, and at one location by variation in levels of pantothenic acid intake. Analyses will include nitrogen, fat and minerals to show intake-excretion balances, and urinary excretion of vitamins in relation to intake. Data will be available on 24 subjects, within limited ranges of age and height.

Plans: Laboratory work at these locations will probably be completed during the year.

6. Metabolic Patterns of 7-9 Year Old Girls

HN

Analyses have been completed, and data summarized on one phase of the Southern Region cooperative investigation of the metabolic response of preadolescent girls to a diet of commonly served foods, supplying nutrients at approximately the levels suggested by the National Research Council. These data (obtained from 11 girls at the Louisiana and Tennessee stations) will be combined for publication with data resulting from the second phase -- this year's study of 12 girls at the Virginia station. The Human Nutrition Research Branch has been responsible for staff assistance during the actual feeding periods, and for carrying out the analyses of fat in food and fecal samples, of folic and pantothenic acid in food and urine, and of analyses (through contract) of tryptophan and niacin derivatives in urine. Experience gained in the management and methodology of this study will make a considerable contribution to research in human metabolism.

Plans: Analyses will be completed and reports prepared for publication.

7. Basal Metabolic Rates in Children

HN

Basal metabolic data on 300 children, mostly 9-11 years of age, obtained over a period of years, are being analyzed and prepared for publication. During the year, these data have been augmented by unpublished data on 380 children 12-14 years old, measured at the University of Arizona; on 250 children 15-16 years old, measured at the State College of Washington; and on 127 children 2-15 years old measured at the University of Colorado School of Medicine, Denver. This compilation will provide needed reference data for many types of nutrition research.

Plans: The data will be prepared for publication.

8. Heights and Weights of U. S. Population Groups

HN

During the year, a small edition of the preliminary tabulations of original data on heights and weights of U. S. children since 1920 was issued for clearance with contributors. As a result, considerable additional data have been made available, particularly for late adolescence. The summarization is now being extended to include among others the following data on adults: a geographic summary of the height and weight data reported in the food consumption survey of 6,000 families made by USDA in 1955; unpublished data on more than 150,000 students collected in 1950 by Colleges and Universities; and data from recent regional cooperative studies of nutritional status of older persons in States of the North Central and Western Regions. Cooperation in supplying the many data has been most encouraging. Although the summary was intended primarily for reference by nutrition investigators, many scientific groups are showing interest in the material.

Plans: The analyses will be completed and data prepared for publication.

Publications:

HN

Nutritional Requirements

"The Quantitative Amino Acid Requirements of Young Women. I. Threonine." Ruth M. Leverton, Mary R. Gram, Marilyn Chaloupka, Eileen Brodovsky and Amy Mitchell. (Nebraska) Journal of Nutrition, Vol. 58, No. 1, 59-81, Jan. 1956.

"The Quantitative Amino Acid Requirements of Young Women. II Valine." Ruth M. Leverton, Mary R. Gram, Eileen Brodovsky, Marilyn Chaloupka, Amy Mitchell and Norma Johnson. (Nebraska) Journal of Nutrition, Vol. 58, No. 1, 83-93, January 1956.

"The Quantitative Amino Acid Requirements of Young Women. III. Tryptophan." Ruth M. Leverton, Norma Johnson, Jean Pazur, and Joan Ellison. (Nebraska) Journal of Nutrition, Vol. 58, No. 2, 219-299, Feb. 1956.

"The Quantitative Amino Acid Requirements of Young Women. IV. Phenylalanine. - With and Without Tyrosine." Ruth M. Leverton, Norma Johnson, Joan Ellison, Donna Geschwender and Florence Schmidt. (Nebraska) Journal of Nutrition, Vol. 58, No. 3, 341-353, March 1956.

"The Quantitative Amino Acid Requirements of Young Women. V. Leucine." Ruth M. Leverton, Joan Ellison, Norma Johnson, Jean Pazur, Florence Schmidt and Donna Geschwender. (Nebraska) Journal of Nutrition, Vol. 58, No. 3, 355-365, March 1956.

"Amino Acid Requirements of Young Women Based on Nitrogen Balance Data. I. The Sulphur-Containing Amino Acids." Marian E. Swendseid, Iona Williams and Max S. Dunn. (California) Journal of Nutrition, Vol. 58, No. 4, 493-505, April 1956.

"Amino Acid Requirements of Young Women Based on Nitrogen Balance Data. II. Studies on Isoleucine and on Minimum Amounts of the Eight Essential Amino Acids Fed Simultaneously." Marian E. Swendseid, and Max S. Dunn. (California) Journal of Nutrition, Vol. 58, No. 4, 507-517, April 1956.

"A Standardized Diet for Metabolic Studies--Its Development and Application." F. L. Meyer, M. L. Brown, H. J. Wright, and M. L. Hathaway. Tech. Bul. 1126, 81 pp., illus. Nov. 1955.

"Starches, Sugars and Related Factors Affecting Liver Fat and Nitrogen Balances in Adult Rats Fed Low Levels of Amino Acids." Madelyn Womack and Mary W. Marshall. Journal of Nutrition, Vol. 57, No. 2, 193-262, October 1955.

"Fat in Diet of Infants in Relation to Caloric Consumption, Growth, and Serum Levels for Specific Fatty Acids." Arild E. Hansen, Hilda F. Wiese, Marjorie Lawlis, Doris J. D. Adam, Armond Goldman, and Marjorie Baughan. (Texas) American Jr. Diseases of Children, 90, 621-622, 1955.

"Effect of Intake of Linoleic Acid on Unsaturated Fatty Acids of Serum of Infants." Hilda F. Wiese, Arild E. Hansen, Doris J. D. Adam, and Marjorie A. Baughan. (Texas) Federation Proceedings, 15, p. 577, 1956 (Abstract).

Food and Nutritional Status Cooperative Studies

Western Region

"Cooperative Nutritional Status Studies in the Western Region. I. Nutrient Intake." E. B. Wilcox, H. L. Gillum, and M. M. Hard. West. Region. Bul. 383, 44 pp., illus. 1956. (West. Region. Proj., Human Nutrition Res. Br. cooperating.)

"The San Mateo Study of the Nutritional Status of the Aging." Agnes Fay Morgan. California's Health 13, No. 9, 65-72, 1955 (California)

"Nutritional Status of Adolescent Idaho Children. II. Food Habits." K. P. Warwick, S. W. Bring and E. Woods. American Dietetic Association Journal 31: 1143-1146, 1955 (Idaho)

"Nutritional Status of School Children 15 and 16 Years of Age in Three Idaho Communities; Blood Biochemical Tests." S. V. Bring, K. P. Warwick, and E. Woods. Journal of Nutrition 57: 29-45, 1955. (Idaho)

"Dietary Studies of Montana 15 Year Olds and Montana College Freshmen." L. M. Odland, L. Page, and L. Guild. Montana Agr. Expt. Sta. Bul. No. 518, April 1956. (Montana)

"Dental Studies with Montana College Freshmen and Adolescents." L. M. Odland. Bulletin of American Association of Public Health Dentists 16: 6, 1956. (Montana)

"Nutrient Intakes and Food Habits of Montana Students." L. M. Odland, L. Page and L. P. Guild. Am. Dietetic Assn. Jr. 31: 1134-1142, 1955. (Montana)

"Dental Caries Experience of Montana Students." L. M. Odland, L. Page, and S. T. Dohrman. Amer. Diet. Assoc. Jour. 31(12): 1218-1222, illus. Dec. 1955. (West. Region. Proj., HNRB cooperating.) (Montana)

"Bone Density Relationships in Adolescence." (Abstract) L. M. Odland. Federation Proceedings 15 (1, pt. 1): 567. March 1956. (Paper presented at Amer. Inst. of Nutr., April 1956.) (Montana State College, HNRB cooperating.)

"Nutritional Status of Selected Adolescent Children. I. Description of Subjects and Dietary Findings." M. M. Hard and N. C. Esselbaugh. (Washington) Amer. Jour. of Clinical Nutrition 4, 261-268, 1956.

North Central Region - Older Women

"Food Intake and Body Weight of Older Women." P. Swanson, H. Roberts, E. Willis, and others. Proc. of the Weight Control Colloquium 80-96, 1955. (Iowa)

"Your Passport to Good Health." P. Swanson, and E. Willis. Iowa Farm Sc. 10(3), 17-19, Sept. 1955. (Iowa)

"Let's Reduce Sensibly." P. Swanson, and E. Willis. Iowa Farm Sc. 10 (1), 6-8, July 1955. (Iowa)

"As Women Grow Older." A. Biester, E. Zeitler. Farm and Home Sc. 12(3), 17-19, 1955. (Minn.)

"Food Habits of South Dakota Women." L. Burrill, and B. Alsup. So. Dakota Agri. Expt. Sta. Bul. 451, 24 pp., May 1955. (South Dakota)

North Central Region - School Children

"Very Heavy and Obese Children in Iowa." E. S. Eppright, I. Coons and E. Jebe. Jour. of Home Ec. 48: 163-172, 1956. (Iowa)

"Food Intake and Body Size of Iowa School Children." E. S. Eppright, V. D. Sidwell, and E. Jebe. Proc. of the Weight Control Colloquium, 119-131, 1955. (Iowa)

B. PROPOSALS FOR COMMITTEE CONSIDERATION ON
II. HUMAN NUTRITION

(Order of listing has no priority significance)

- A. Fat in Nutrition -- Initiate research to investigate the role of fat in human nutrition, such as the relationship of the amount and kinds of fat to metabolism of other nutrients, determination of desirable upper and lower limits of fat intake in the various nutritional situations, the physiological effect of fat artifacts arising from modern food processing, and the dietary precautions needed when different types of fat in diets are unusually high or low.

This research is urgent in view of the growing evidence of the relation of the nature of dietary fat to the development of biochemical changes in blood and to renal-cardiovascular damage. Studies of aging persons and of laboratory animals on abundant diets have implicated high-fat, high-calorie diets in some disorders of metabolism. For various reasons, the average proportion of fats in U. S. diets has increased from 32 percent in 1910, to 41 percent in 1955. However, there are wide variations in the percentage of the calories from fat as well as in the types of fat in the diets of some individuals, which has been further complicated by the effects of modern food processing such as deep fat frying and hydrogenation. The problem requires more attention to compositional factors and improved methodology in all phases of the investigations.

- B. Fatty Acid Requirements of Various Age Groups -- Initiate research to determine the requirements of various age groups for the long-chain "essential" fatty acids, with particular attention to adolescents, and to adults.

Some approximation has been made of the probable need of infants and young children for linoleic acid. Comparable information should be obtained for other age groups, particularly for adolescents, adults in the late thirties, and adults over 60 years of age. Data are needed showing the biochemical response to diets containing different amounts and caloric proportions of linoleic acid in the forms commonly found in foods, including analyses of the fatty acid content of blood, and of cholesterol, phospholipids and other suitable substances related to fat metabolism.

- C. Physiological Availability of Nutrients from Foods -- Expand research to determine the physiological availability of various nutrients from different foods, and the extent to which food processing, other food constituents and diet patterns affect their availability.

This information is needed for appraising the nutritional value of various diets and for predicting the value of diets planned for specific situations. Particular attention should be given to the physiological availability of amino acids from different types of foods and from diets representing typical food habit patterns. This

work calls for digestibility and metabolic studies using human subjects, and for improved techniques in the analyses for many nutrients.

- D. Nutritional Requirements for Newer B-vitamins -- Initiate research to determine human requirements for pyridoxine, pantothenic acid, folic acid and related B-vitamins, in normal young adults.

Research using "normal" young adults should be conducted to determine requirements under identical conditions for those B-vitamins on which data other than clinical are scarce. Consideration should be given to the types of diet pattern used, and to the proportions of other nutrients present, including the well known B-vitamins -- thiamine, riboflavin and niacin -- and the amino acids and fatty acids.

- E. Dietary Factors Affecting Amino Acid Requirements -- Expand research on the effect of type of carbohydrate in the diet on amino acid utilization to include other components of diet, and other biochemical and physical criteria of the nutritional effects.

Attention should be given to "non-essential" amino acids and non-protein nitrogen, as well as to "essential" amino acid ratios in the diet, to intact food proteins, to carbohydrates commonly found in some of the processed forms of foods as eaten, and to possible effects of kinds and amounts of fat. The criteria should include, in addition to studies of nitrogen balance and calorie utilization, analysis of blood and other tissues by histological and chemical means. This basic information is needed for determining protein and other nutrition requirements of people consuming diets of different patterns.

- F. Effect of Mineral Interrelationships in Nutrition -- Expand studies on mineral interrelationships in nutrition.

The ways in which the level of any one essential element present in the food affect the functioning of other elements are not well established. For example in the course of studies of the effect of high levels of molybdenum on the copper status of the animal, the observation was made that a sulfur amino acid would alleviate the growth retardation produced in laboratory animals. This and related observations point to the need for studies such as determination of the effect of varying levels of molybdenum and copper to determine how these elements are interrelated in the metabolism of animals. Such information is essential for an understanding of nutrient imbalancing of diets by mineral elements.

III. FOOD QUALITY AND HOUSEHOLD USE

A. PROGRESS ON WORK UNDER WAY

1. Breeding and Quality Evaluation - Cereal Crops

FC

Wheat -- Results obtained from quality studies were used as the basis for designating 24 varieties of wheat as unworthy of full government support under the CSS loan program. This is the first time that varietal differences in quality have been utilized in this manner and it points up the increasing importance of making comprehensive quality tests on new varieties before release. Certain varieties have shown greater stability than others under diverse weather conditions, as expressed by protein quality, textural characteristics, ash, pentosan, and polysaccharide content. Precise means for measuring these environmentally induced and hereditary characteristics are being studied.

Rapid routine quality tests for use in the laboratory or grain market are being studied. The sedimentation test (cooperative with AMS) gives a combined value for protein content and protein quality; the dye-binding test provides a more rapid and simple test for protein content, the 5-gram mill provides some evidence on milling value, and physical dough characters are indicated by various machines. None of these is adequate in its present form and with present equipment for routine quality evaluation without reference to milling and baking determinations.

It is estimated that fungal enzymes are used in making between 60 and 75 percent of baker's bread in the U. S. Protease and alpha-amylase supplements, to a considerable degree, are the outgrowth of much basic research done cooperatively at the Kansas Station. Properly supplemented flour produces loaves that are symmetrical and soft, and superior in grain and texture characteristics to those normally obtained by use of other enzyme supplements. More precise enzymatic control in varietal evaluation is now possible. The line project under which this work was conducted has been closed and a summary paper prepared.

The starch tailing fraction in flour was shown to be closely associated with the quality of sugar snap cookies, especially with respect to spread and top grain score. This material, high in pentosans, consists principally of endosperm cell wall tissues.

Corn: The commercial production of waxy corn was expanded somewhat in 1955. Previously the production of waxy hybrids has been limited to northcentral Iowa. The Hubinger Milling Company of Keokuk is now milling waxy corn. New tests were started in southeast Iowa to provide information on relative performance for this area. Several new hybrids are available which are superior to US13 waxy in yield. Recent technological developments have provided a new outlet for waxy starch. Methods have been developed to utilize waxy starch in the manufacture

of plastics. This potential outlet is being reflected in an approximately 60 percent increase in acreage for 1956. Studies were completed on a series of waxy mutants having intermediate starch properties. Mechanical mixtures of normal and waxy starch did not parallel the pasting characteristics of the intermediate mutants.

2. The Effects of Diethylstilbestrol Supplementation on Quality of Beef

APH

A study has been made of the important meat quality factors in two year old and yearling steers when finished on a well balanced fattening ration supplemented with 10 mg of diethylstilbestrol per day per animal for 84 and 180 days.

The two year old 900 pound beef-type steers fed 84 days on the standard ration were fatter than similar steers which received the D.E.S. supplement. When yearling 600 pound beef-type steers were fattened for 180 days with and without D.E.S. supplement there was no difference in fatness. In both cases the test steers had slightly heavier livers, pituitary and adrenal glands, slightly plumper rounds and a slightly higher percentage of moisture in the fat over the 12th rib. There was little or no difference in carcass grade; they all graded low Choice. Neither were there any differences in dressing yield, area of eye muscle, percentage of moisture in the eye muscle and semitendinous muscle, tenderness and flavor of fat and lean in the heated roasts.

The differences in average muscle fiber diameters for the two lots of two year old and two lots of yearling steers were not consistently different. However, in both age groups the semitendinous and psoas muscle fibers were slightly larger; the longissimus dorsi muscles, from the experimental animals were smaller.

There was no evidence that supplementing a beef cattle fattening ration at the level of 10 mg per day per animal with D.E.S. resulted in the meat having acquired an estrogenic effect, as determined by mouse assay in the Food and Drug Administration.

Plans: Continuation of the work using identical twin calves and supplementing the rations with D.E.S. and an antibiotic.

3. Inheritance of Tenderness

APH

The quantitative distribution and amount of collagen and elastin and the average fiber diameter, using rabbits as the experimental animal, indicates that these factors are, along with others, related to tenderness. Further analysis of the data shows them to be hereditary. These findings are from the histological examination of 466 samples of longissimus dorsi tissue stained specifically for collagen and or elastin.

Plans: The techniques developed in this study are being used on samples of beef muscle from animals represented by different sires and

sire lines to establish the relationship of inheritance of tenderness in meat producing animals. Research is also being directed toward the selection of one muscle as being representative for the carcass. Biopsy technics and sampling procedures are being developed for anticipated use in the selection of breeding stock that will not only produce more tender beef, but beef with a more desirable amount and distribution of intramuscular fat.

4. Quality of Pork from Hogs of High and Low Degree of Fatness

APH

Inheritance of fatness in hogs is being studied with the objective of determining the proper proportion and distribution of fat necessary for high quality pork.

Data have been collected from the first year's work with Duroc Jersey pigs being considered the fat breed for this study and Yorkshires, the representative thin breed. The dressed carcasses from pigs representing the low degree of fatness had thinner back-fat, higher yield of preferred cuts, longer carcasses, thinner bacon, less plump hams and larger area of eye muscle than pigs representing the high degree of fatness. There was little difference in the intensity of flavor of fat and lean in the loin roasts representing the two degrees of fatness. However, the roasts from those pigs with the high degree of fatness were slightly more tender and more juicy and the desirability of flavor of lean was more acceptable. Associated with these palatability scores was a larger drip loss from the loin samples representing hogs of high degree of fatness. All loin samples were trimmed to a uniform thickness of fat. All of these hogs were fed in R. O. P. tests and were finished on a standard fattening ration until they individually reached a final feedlot weight of approximately 225 pounds.

Plans: Continued work on the important meat factors as related to degree of fatness of the carcass. Additional histological and chemical analysis will be made to determine the inter- and intra- fibular fat distribution and amounts as they affect quality in pork.

5. Quality of Lamb Meat Affected by Breeding, Feeding and Management

APH

Additional evidence has been obtained that lamb carcasses and their meat characteristics continue to show improvement through breeding, based on five year's data on lambs from four pure breeds, five two breed dams and three breed sires and dams. The lambs were slaughtered when they reached a final weight of approximately 75 pounds. However, palatability data from lamb leg samples, representing the various breeds and crosses, indicated little difference in the quality factors of intensity and desirability of flavor of fat and lean.

The purebred Southdowns were the more tender, but this was overcome by crossing. Likewise all first cross lambs had less tender roasts than the parent purebred representatives.

Plans: Continue at present level in breeding studies. Expand research studies on those important quality factors of yield, composition, grade, tenderness and palatability as affected by feeding, management, age and sex.

6. Palatability of Poultry Affected by Diet

HN

A series of cooperative investigations implicate ration ingredients as the source of off-flavor and other subnormal quality characteristics in poultry as marketed. In one of these studies, cooperative with APH-ARS, roasting turkeys were graded fatter when fed high proportions of fish products in the ration and were downgraded more for predominant fishy off-flavors when the diet contained white fish meals than when sardine meal was used. The fatter the turkeys, the worse the fishy off-flavor. Linseed oilcake as a ration component resulted in more downgrading for off-flavors than did edible oilcake meals. In another study, cooperative with Fish and Wild Life Service, Department of Interior, the fishy off-flavors were reduced when chickens were cooked in ovens at 400° F. instead of 325° F. The use of an antioxidant (DPPD) in the poultry diet also was effective in decreasing the off-flavor. Nearing completion is another study cooperative with APH-ARS on the cooking and eating quality and cooked yield of turkeys of fryer-roaster size in relation to live and ready-to-cook weights when different kinds of protein, different levels of fat and different forms of added vitamins A and D were used in diets to accelerate growth.

Plans: During the year, attention will be given to flavor and cooking quality of slow-growing and fast-growing chickens, coop. APH-ARS.

7. Predetermining the Cooking Quality of Rice

HN

In order to predict the cooking quality of rice varieties before they are put into large-scale production and the quality of rices available for shipment to different consuming areas, an easily controlled cooking method has been developed and test procedures standardized, for use with small quantities such as are available to the geneticists. The method was pretested on 9 varieties of long, medium and short grain rices of known history and found to differentiate qualities such as cohesion, tenderness and starch characteristics, wanted for different consumer purposes, or suited to the food habits of different domestic and foreign groups. It is being further tested on 74 lots of rices from various geographic locations and of rices exposed to different drying and processing temperatures. Use of the method should aid in distributing and marketing rice, as well as in producing, varieties more adaptable to the needs of different rice consumer.

Plans: Analyses on the 74 lots will be completed and the work discontinued.

8. Quality of Pressure-Cooked Potatoes

HN

The quality of pressure-cooked potatoes, studied under contract at Pennsylvania State University, was found to differ with the specific gravity and variety of potatoes. Sloughing and mealiness increased with specific gravity, but less sloughing resulted from sliced potatoes cooked a shorter time than from whole potatoes. Sliced samples of Chippewas and Katahdins were superior in color to whole tubers, but the reverse was true for Russet Burbanks, the most mealy of the varieties studied.

Plans: This study has been completed and no new work on potatoes is anticipated at this time.

9. Fruit Jellies with Added Pectin

HN

Laboratory studies on jellied fruit products made with added fruit pectins have been carried out to develop ways to help conserve full-flavored ripe fruit, and to provide information for revising a favorite but out-of-date homemaker bulletin on jelly making. Eight kinds of fruit -- apples, blackberries, cherries, currants, grapes, peaches, plums and strawberries -- and five different pectins were studied. Liquid and powdered pectins from both apple and citrus sources were included. Storage tests up to 6 months showed that most fruit jellies change very little in firmness, and that color and flavor were retained better at refrigerator than at room temperatures.

Plans: This work has been completed and materials prepared for a technical bulletin, also for a revised homemaker bulletin.

10. Measurement of Food Quality

HN

Recent progress in food quality measurements gives strength to many lines of research in this area. Measurements of food quality involve use of suitable physical, chemical, histological, sensory and statistical techniques. Improvements in some of these criteria are summarized below with only incidental reference to the commodity:

- a. Physical procedures recently standardized for measuring food quality characteristics include the following: Use of a line-spread grid for recording consistency of apple sauce; use of wax models of potatoes to guide judges in rating degree of color, texture and sloughing; use of a specially constructed paddletester to measure resistance to turning as an index of jelly consistency; colorimetric determinations of starch loss in cooking water of rice as related to variety; and application of a number of new-types of equipment or precision meters for measuring quality characteristics.
- b. Histological work in a study of quality of apples provided explanation for the break-down of skin and texture during storage and during cooking of baked apples; histological

techniques with cooked rices afforded explanation of results obtained from different methods of cooking and different rice varieties.

- c. Statistical procedures are applied extensively in the design, conduct, and analysis of reasearch in food quality. Both food specialists and statisticians have contributed to the planning and review of technical reports in statistical techniques for sensory testing of foods performed by the Virginia station under ARS contract. In Branch laboratories, designs developed for experimental work must be applicable throughout the sampling, experimental treatments and objective and palatability testing.

For palatability analyses, diverse statistical designs are required; adjustments are made as necessary to adapt conventional statistical designs to restrictions imposed by special problems connected with limitations in food samples, cooking procedures or taste testing. Since 1954, designs have been adapted and used for more than 30 experiments in palatability evaluation. For these, 13 were randomized block, 10 were lattice (partially balanced except one complete); the others included Latin square, Graeco-Latin square, Youder Square, and incompleted block and split block. Some of the restrictions imposed affect randomization, such as keeping quality of the food, the number of samples which can be served simultaneously as governed by taste fatigue, temperatures for judging, rates of cooking, order of dilution of dominant flavors.

- d. Replications have been found essential in food quality research, not only in market lots, in cooking methods and sampling for analytical measurements, but also replication in season, crop year and locale of production, as well as among judging panels, laboratory teams and in practical situations in household or restaurant kitchens. Various replications become especially important when the test is to serve as the basis for some national practice or regulation. In some instances the results are confirmed. For example, panels at the Connecticut Station and the Branch carried out tests simultaneously on poultry fed different fish meals and came up with identical answers as to levels of tolerance allowable in the ration. In other instances, the opposite is true. For example, during a study on potatoes from different locations for three consecutive crop years, some of the results obtained the first year were reversed or modified later due to different conditions of production. Also, minor adjustments were made in fruit jelly and jam formulas developed in the laboratory after evaluation of the products obtained by home-makers replicating these formulas, using their own kitchen and equipment after purchasing fruit in their own markets. Because of the importance of various replications, yield data for vegetables procured in different regions and prepared in different institutions were considered of more value than replicate purchases from the same market prepared by the same

person in the same kitchen or laboratory.

Plans: As opportunity permits, improvement in techniques will be sought in current lines of work on various commodities, and used whenever applicable in other research.

11. Changes in Egg Quality During Distribution

MCC

Data to appraise changes in the quality of eggs when two methods of distribution are used are being collected as part of a study on marketing margins and costs for eggs. The two methods being studied are: (a) Shipment of eggs in 30-dozen cases from assembly points in the Midwest to Eastern cities where they are recandled and packaged in one-dozen cartons for sale to retail stores; and (b) shipment of eggs in one-dozen cartons between the same points without further candling or packaging in an Eastern city. If this latter method proves feasible, it could result in substantial savings in the cost of marketing eggs.

12. Effects of Pesticides on Food Quality and Flavor

ENT

ADP

DH

HN

HC

The production of marketable wholesome food is dependent upon the judicious use of a variety of potent insecticides. Their extensive use brings about new problems each year on residues and effects on quality and flavor. Therefore, continued research investigations are required to solve these problems as a part of the over-all program to develop safe and effective chemicals for controlling insects affecting plants and animals. The chief objective is commercial control of destructive insects without leaving injurious residues or adversely affecting the quality or flavor of crops or their products. The implementation of Public Law 518, including the establishment of tolerances for pesticide chemicals in or on raw agricultural commodities by the Food and Drug Administration, HEW, has greatly increased the demand for information on pesticide residues in or on foods, forage crops, animal products, and the soil. Tolerances are expressed as parts per million (ppm) and vary depending upon the toxicity of the insecticide and the extent to which different foods are consumed by people. After insecticide tolerances are set, any agricultural products in trade channels that exceed such tolerances are subject to seizure and condemnation. Much research on insecticide residues is required therefore before new materials can be recommended for insect control which will meet tolerances and guarantee wholesome and safe food to the consumer.

Research on insecticide residues is conducted by ENT at field stations located throughout the country, often in cooperation with state agricultural experiment stations, growers, and insecticide manufacturers. Investigations at Beltsville, Maryland, are co-operative with ADP, DH, HN and HC.

a. Vegetables

ENT
HC
HN

HN conducted palatability evaluations to determine whether the flavor of sweetpotatoes, Irish potatoes, turnips, summer squash, and winter squash was affected by insecticides used in their production. No off-flavors were observed in sweetpotatoes following soil applications during growth of four different insecticides for control of sweetpotato weevils. No flavor defects, attributable to insecticide treatments tested, were observed in Irish Cobbler or Cherokee potatoes or in turnips grown in soils treated with 3 or 6 pounds per acre of heptachlor; in mushrooms exposed to malathion spray or dust; or in summer squash (3 varieties) treated with lindane at a cumulative total application of 1.75 pounds per acre. Winter squash (2 varieties) from plants treated with 1.75 pounds per acre of lindane were scored as having significantly more off-flavor than untreated squashes of the same varieties; however, no significant off-flavors were observed last year in winter squash following the same insecticide treatment.

In cooperative work with HC, off-flavors were found in carrots and turnips grown in soil treated in previous years with heavy applications of benzene hexachloride. No carry-over effects in carrots and turnips were found for chlordane, DDT (technical), dieldrin, marlate, TDE, and toxaphene. There was some indication that turnips might be affected following high level aldrin and heptachlor-treated crops.

Plans: On vegetables, to continue research on (1) the effects of the newer insecticides on plants and soils when used on various crops under a wide variety of conditions; (2) the effects of these insecticides on crop quality and flavor; (3) the problem of absorption by plants of insecticides, their translocation to edible parts of the plants and the possible formation of harmful degradation products; and (4) determining the quantities of insecticide residues remaining on edible parts of vegetables and other crops when insecticides are applied at various times during the development of these crops as a basis for making sound insect control recommendations.

b. Animal Products

ENT
ADP
DH
HN

One very important need is to determine the extent to which insecticides store in meat and milk when used on animals to control destructive insect pests or on forage which is fed to livestock. As new insecticides are tested for insect control, studies to determine hazards to the consuming public should be made simultaneously. Insecticides such as DDT, toxaphene, dieldrin, and aldrin cannot be used on dairy cattle since they are secreted in the milk. Other chlorinated hydrocarbon insecticides and the organic phosphorus insecticides show promise of less storage in both milk and fat of animals.

This research is conducted at Kerrville, Texas by ENT and ADP in cooperation with the Texas and Oklahoma Agricultural Experiment Stations, industrial concerns, and livestock growers. At Beltsville, Maryland, studies are carried out jointly by ENT and DH.

Since methoxychlor is recommended for control of horn flies on cattle, it seems advisable to obtain more information on its excretion in milk when used on dairy animals. Two dairy herds were sprayed with 2 quarts of 0.5 percent methoxychlor per animal. Composite milk samples from each herd showed maximum residues averaging 0.17 to 0.11 ppm one to 3 days after treatment respectively. Samples taken 1 to 3 weeks after treatment averaged 0.04 to 0.01 ppm respectively.

Toxaphene applied to cattle provides excellent control of ticks, lice, and other pests. However, toxaphene was found to be excreted in the milk after spraying individual dairy cows with 0.5 percent suspensions and wettable powders. The amounts varied from 0.47 to 0.92 ppm during the first and second day after spraying. At 14 days the residues had decreased to an average of about 0.10 ppm.

Two cows were sprayed twice daily with one ounce of 2.0 percent toxaphene oil spray. They excreted an average of 0.41 ppm in the milk 3 days after spraying started. There was a slight decrease in residues during the remainder of the 21-day period.

Toxaphene is also a useful insecticide for the control of several injurious insects on forage crops. It is important to know if this insecticide is excreted in milk when dairy cattle feed on treated rations. When toxaphene-treated feed was fed daily to dairy cows at dosages ranging from 20 to 140 ppm for an 8-week period, the insecticide was excreted in the milk at all dosage levels and at a rate of roughly 1 percent of the dosage given. One and two weeks after feeding ceased, the residue averaged 0.07 and 0.02 ppm at the 20 ppm feeding level.

Samples of fat, liver, and kidneys from pigs that had grazed for several months in pastures treated with granulated aldrin and dieldrin were analyzed. Small amounts of these materials (less than 1 ppm) were found in some of the samples.

In cooperation with industrial concerns, good progress has been made in developing or refining sensitive and reliable methods for measuring insecticidal residues in meat and milk. Refinements in methods have been developed for methoxychlor and toxaphene.

Plans for Future Work on Insecticidal Residues (Animal Products) ENT

Plans are to expand these studies because of the importance of determining the exact levels of different insecticidal residues in

milk and meat. These data are required in order that toxicologists may ascertain whether or not the residues are excessive from the viewpoint of human health and entomologists must have it before making recommendations to growers on the use of different insecticides for the control of pests on food crops.

Publications:

Breeding and Quality Evaluation - Cereal Crops

FC

"Progress in Wheat Breeding for Quality in North America," A. M. Schlehuber. Proceedings, Third International Bread Congress, Hamburg, Germany. 1955.

"The Research Program on Cookie Quality at the Soft Wheat Quality Laboratory," W. T. Yamazaki. (Processed) 1955.

"Fungal Enzymes in Baking," B. S. Miller and J. A. Johnson. The Bakers Digest 29(5): 95-100, 166-67. 1955.

"Properties of Certain Protease Systems Used in Breadmaking," J. A. Johnson, B. S. Miller, P. D. Boyer, and W. F. Geddes. Cereal Chem. 33: 1-17. 1956.

Cooking Quality and Palatability of Food

HN

"The Effect of Moist and Dry Heat Cooking on Palatability Scores and Shear Force Values of Beef from Animals of Different Levels of Fleshing." Sylvia Cover and Myrtis Conry Shrode. (Texas) Journal of Home Ec. 47 (9):681-685, November 1955.

"The Effect of Moist and Dry Heat Cooking on Vitamin Retention in Meat from Beef Animals of Different Levels of Fleshing." Sylvia Cover and W. H. Smith, Jr. (Texas) Food Research 21(2): 209-216, March-April 1956.

"The Relationships Among the Age of the Animal, Carcass Grade, and Extent of Cooking with Certain Organoleptic, Chemical, Physical and Microscopic Characteristics of Beef Muscles." Belle Lowe and Joseph Kastelic. Iowa Experiment Station Technical Bulletin. In press.

"Study of Three Cuts of Lower and Higher Grade Beef, Unfrozen and Frozen, Using Two Methods of Thawing and Two Methods of Braising." F. Fenton, I. T. Flight, D. S. Robson, K. C. Beamer, and J. S. How. Cornell Expt. Sta. Memoir 341, March 1956.

"Effect of Cold Storage and Method of Cooking on Commercial Grade Cow Beef." P. Paul, M. Bean, and L. J. Bratzler. Mich. State Expt. Sta. Tech. Bul. 256, May 1956.

"Quality of Pressure-Cooked Potatoes." E. Elizabeth Hester and Grace Bennett. (Pennsylvania) American Potato Journal. In press.

"French Frying Quality of Potatoes as Influenced by Cooking Methods, Storage Conditions and Specific Gravity of Tubers." Mary E. Kirkpatrick, Peter H. Heinze, Charles C. Craft, Beatrice M. Mountjoy, and Claire E. Falatko. U. S. Dept. of Agri. Tech. Bul. No. 1142, March 1955. (Coop. with AMS)

"Cooking Quality and Flavor of Eggs, as Related to Canded Quality, Storage Conditions, and Other Factors." Elsie H. Dawson, Cora Miller, and Ruth Redstrom. U. S. Dept. of Agri. Information Bulletin. In press.

Food Preparation and Preservation

HN

"Cooking Rice for School Lunches." Olive M. Batcher, Katharine F. Helmintoller, and Elsie H. Dawson. Journal of Home Economics, Vol. 48, No. 1, 36-37, 1955.

"Cooking Rice in Quantity." Food and Home Notes, USDA 3203-55, December 14, 1955.

"Cooking White Rice." Processed Publication, ARS 61-2, 15 pages, August 1955.

"Cooking With Dried Egg." U. S. Dept. of Agr. Home and Garden Bulletin. In press.

"Potatoes in Popular Ways." Mary E. Kirkpatrick and Claire E. Falatko. U. S. Dept. Agri. Home and Garden Bulletin. In press.

"Get More Good From Milk." Processed Publication, ARS 61-3, 15 pages, May 1955.

"Cornmeal in Family Meals." Processed Publication, AMS-11, 4 pages, April 1955.

"Home Canning of Fruits and Vegetables." U. S. Dept. Agr. Home and Garden Bulletin No. 5. Revised. In press.

"Freezing Sweetpotatoes in School Lunch Kitchens." Processed Publication, AMS-108, 2 pages, March 1956.

Effect of Agricultural Chemicals on Food Flavor

HN

"Flavor Tests on Potatoes Grown in Soil Where Lindane Was Applied to Cucumbers." Mary E. Kirkpatrick, Grace S. Linton, Beatrice M. Mountjoy, and Linda C. Albright. American Potato Journal, Vol. 32, No. 7, 259-264, July 1955.

"Some Effects of Insecticide Spray Accumulation in Soil Upon Crop Plants." Arthur C. Foster, Victor R. Boswell, Robert D. Chisholm, Louis Koblitsky, Roscoe H. Carter, Gladys L. Gilpin, Bailey B. Pepper, W. S. Anderson, and Marvin Gieger. U. S. Department Agr. Technical Bulletin No. 1149, Aug. 1956. (Coop with HC)

Insecticide Residues

ENT

"Insecticide Recommendations of the Entomology Research Branch for the Control of Insects Attacking Crops and Livestock: 1956 Season." U. S. Dept. of Agr., Agr. Handbook No. AH 103.

"European Corn Borer Control in Relation to Malathion Residues." H. C. Cox, J. E. Fahey, and T. A. Brindley, Jour. Econ. Ent. (in press).

"Status of Analytical Methods with Respect to the Determination of Minimal Quantities of Insecticides." R. H. Carter, Jour. Econ. Ent. 48: 424-425. August 1955.

"Determination of Lindane in Mushrooms." Irwin Hornstein, Jour. Agr. and Food Chem. 3: 342-349. October 1955.

"Granulated Insecticides for European Corn Borer Control." H. C. Cox, T. A. Brindley, W. G. Lovely, and J. E. Fahey, Jour. Econ. Ent. 49: 113-119, February 1956.

"Excretion of Heptachlor Epoxide in the Milk of Dairy Cows Fed Heptachlor-sprayed Forage and Technical Heptachlor." R. E. Ely, L. A. Moore, P. E. Hubanks, R. H. Carter, and F. W. Poos. Jour. Dairy Sci. 38: 569-572. June 1955.

"DDT Residues in Fat from Steers Pastured on Corn Stover in DDT-treated Fields." Jack E. Fahey, Tom A. Brindley, and Maynard L. Spear. Jour Econ. Ent. 48: 606-607. October 1955.

"Insecticide Residues in Meat and Milk." H. V. Claborn, USDA Entomology Research Branch, ARS-33-25, 30 pp. July 1956.

"Residues on Forage, in the Soil, and in Milk Following Pasture Treatment with Granulated Dieldrin." B. A. App, R. H. Carter, and R. E. Ely. Jour. Econ. Ent. 49: 136-137. Feb. 1956.

"Enzymatic Estimation of Dimethyl 2,2-dichlorovinylPhosphate Spray Residues." Paul A. Giang, F. F. Smith, and S. A. Hall. Jour. Agr. and Food Chem. 4: 621-622. July 1956.

"Colorimetric Determination of Methaldehyde Residues on Plants." Paul A. Giang, and F. F. Smith. Jour. Agr. and Food Chem. 4: 623-624. July 1956.

B. PROPOSALS FOR COMMITTEE CONSIDERATION ON
III. FOOD QUALITY AND HOUSEHOLD USE

(Order of listing has no priority significance)

- A. Evaluating Palatability -- Initiate research to develop and standardize more rapid, reliable, and reproducible laboratory methods and procedures for the sensory evaluation of food quality.

The basic physiological, psychological, biochemical, and electrochemical reactions involved in sensory methods of evaluating food should be investigated, parallel with measures of physical, chemical, and histological attributes of foods, and palatability evaluations of color, flavor, and texture, and improved experimental designs and statistical procedures. The problem of measuring palatability is one of great concern to many groups, including producers, manufacturers of pesticides, food processors, and food service managers, as well as to consumers themselves.

- B. Reference Method for Evaluating Effect of Pesticide Residues on Palatability -- Initiate research to standardize reliable procedures for inter-laboratory use in evaluating the palatability of foods, with particular reference to the effect of pesticides and other agricultural chemicals used in production.

Recurring problems in food quality require repeated use of analytical judging of palatability. For efficiency and precision in research progress, and for validity of results as a basis for programs of national action, it is important that procedures using subjective methods be standardized to give reproducible and consistent results in the hands of different workers. The need for uniform methods is becoming more acute, with increases in the number of chemicals used, foods affected, indications of carry-over effects in soil, and aggravating effects of processing. As conflicting reports from different laboratories are brought to bear on legislative action and regulatory programs, the validity of research results is challenged. Food industry journals have pointed out the ridiculous situation of lack of a common reference method for evaluating food flavor. Interested groups are regulatory agencies in Agriculture and in Food and Drug Administration who are faced with problems of conflicting and uncomparable data on which to base decisions, also research leaders in horticultural crops and animal husbandry concerned with crop protection.

The HNRB has been asked to undertake this research cooperative with other interested groups in the Department and in the States, in the interest of food acceptability and consumer welfare in general and as a basic contribution to several technical committees now grappling with problems in palatability evaluation.

- C. Insecticide Residues -- Expand work on insecticide residues including their toxic effects to plants, animals, and soils.

The continued lack of information on residues occurring in foods consumed by man and animals following the use of insecticides is a serious obstacle to their maximum utilization in protecting agricultural crops from attack by insects. The need for expanding work on insecticide residues is emphasized by the many demands placed on the Department of Agriculture to assist agencies of the government, the States, and industry in meeting the rigid provisions of Public Law 518, including available experimental data on residues used in petitioning for pesticide tolerances that are established by the Food and Drug Administration. The budget increase for FY 1957 made it possible to strengthen residue studies on a variety of crops and commodities. However, the additional support is inadequate to meet the many problems involved in determining the effects of insecticides on plants, animals, and soils; residue determinations on or in plants and animals at intervals after insecticide application; and on evaluating the effects of insecticides on quality and flavor of foods. Emphasis needs to be placed on the development of chemical and/or bioassay methods for the determination of trace amounts of insecticidal residues. To meet certain requirements of Public Law 518, bioassay techniques must be developed which will measure the toxicity of degradation products of insecticides occurring in minute amounts which might not be detected by chemical analysis.

- D. Food Qualities Affected by New Methods of Cooking -- Initiate studies to determine the comparative effects of new and different methods of cooking on food qualities and nutritive values.

Such studies should include effects of rate, intensity and mode of heat application, such as effects of pressure cooking, electronic cooking, and other new processes available to institutional and household users. Information as to which foods, qualities and nutrients may be improved, and which may be damaged by some of the new methods of cooking is needed to guide household and institutional (including school lunch) managers and others responsible for food service.

- E. Quality and Safety of Re-Frozen Foods -- Initiate research to determine the effect of thawing and re-freezing on the quality and safety of frozen foods.

Investigations up to the present have been limited to studies of temperature changes occurring during periods of non-operation of home freezers. Users of home freezers require information on the effect of subsequent refreezing on the safety and quality of frozen foods. Samples of frozen foods typical of the various classes (fruits, fruit juice, vegetables, meats, and prepared foods) should be evaluated on the basis of bacteriological examinations of inoculated samples and both bacteriological and palatability tests

on parallel uninoculated samples. Information is needed also regarding the safety of using prestuffed poultry, refrigerated or frozen, before cooking.

- F. Impact of Air Pollution on Food Supply -- Initiate research to determine the impact of air pollution on food supply.

With increasing industrialization of the United States, air pollution has become a serious problem. The tendency toward decentralization of industry and community life has also increased the possible insult of industrial and community pollution upon the agriculture of surrounding areas. Basic research is needed to investigate the possible influence of air pollutants upon the physiology of plants and animal systems which might adversely affect their proper growth, function, and utilization. Accordingly, it is desirable to initiate research on the effects of air pollution and of specific air pollutants upon agricultural products and upon plant and animal welfare.

- G. Prevention of Deterioration of Meat, Poultry and Eggs -- Expand research on the prevention of deterioration of fresh eggs and fresh and frozen meat and poultry to assure higher quality and reduce spoilage losses.

Many important factors are involved in the preservation of fresh meat, poultry and eggs. Research to gain more information should be initiated on isolation, identification and study of micro-organisms responsible for spoilage, trade practices affecting bacterial and mold growth, nature and effect of autolysis, effect of age and other factors on composition and susceptibility to quality change, and relation of time, temperature, humidity and packaging to keeping quality and storage requirements. Special attention should be given to develop methods for reducing spoilage in shipment of fresh products during the summer months. The possibility of using carbon dioxide or other gases in packaging should also be thoroughly investigated now that films have been developed which are impervious to gases.

Research also should be undertaken on the chemical and microbiological factors involved in the stability of frozen precooked meats, meat products and poultry. The utilization of meats of lower economic value could be greatly expanded through the marketing of wholesome, nutritious, and attractive frozen meat dishes. Likewise, the marketing and distribution of many precooked items such as sausages and frankfurters would be improved if they could withstand storage at lower temperatures. Present development in these areas are limited by lack of knowledge of the chemical and microbiological factors involved in storage life and flavor stability. Research is needed if these important avenues of meat utilization are to be developed.

- H. Relation of Composition to Quality in Frozen and Refrigerated Meats -- Initiate studies on the relation of composition to quality in frozen and refrigerated meats.

Improved utilization of lower grades of meat would result if processing methods could be based on a sound knowledge of the relationship of chemical composition to quality factors. Studies on meat proteins, their relation to tenderness, juiciness, and flavor and changes occurring during storage in freezer and refrigerators are urgently needed. Allied structural relationships and the effect of changes in chemical composition on structure are also vitally important to advances in processing technology.

- I. Prevention of Insect Infestation of Food in Marketing Channels -- Expand research on the prevention of insect infestation of food in marketing channels, particularly in reference to the determination of insecticidal residues related to proposed uses to assist in establishing tolerances, or recommending procedures that will hold residues below approved tolerances on both raw agricultural products and manufactured or processed food items; and increased emphasis on insect-resistant packaging to prevent wastage or decreased use of packaged food items.

Certain phases of this broad research program are being expanded but further, and much greater, expansion is urgently needed to meet the needs of the food industry and protect the interests of the consuming public. It is proposed that this research will be expanded in relation to dairy products, dried fruits and nut meats, feed products, cereal, flour and grain products, milled rice, peanuts, and seeds.

- J. Objective Measurement of Quality Factors -- Expand studies leading to the development of new or improved methods and instruments for the objective measurement of quality factors in raw and processed agricultural commodities.

New or improved methods and instruments for measuring quality would aid materially in better quality maintenance during marketing, in the selection of the raw product for processing, the development of improved processing methods, better quality control, and improved grades and standards for the raw and processed product. Accuracy of quality appraisal could be improved if present subjective methods, relying heavily on sensory perception, could be replaced by objective methods. Some of the presently available objective methods are too laborious and time-consuming and require elaborate equipment. There is need for further refinement of methods and redesign of instruments for new applications. Entirely new approaches and new devices employing electronic or mechanical principles are needed in many instances. Procedures that are non-destructive, such as ultrasonic vibration and electromagnetic radiation, should be developed.

Data and principles developed for objective measurement of quality should be adapted to automatic devices for sorting raw commodities and finished products according to various quality requirements.

- K. Composition of Fruits, Vegetables, and Their Products in Relation to Quality and Retention of Consumer Values Through Marketing and Processing -- Expand basic investigations of the composition and physical structure of fruits, vegetables, and their products and their relationship on the one hand to differences in variety, stage of maturity, and environmental conditions of growth, and on the other hand to the changes occurring during the interval between harvesting and processing, during processing, and during storage, including frozen storage. This information is particularly important in determining the degree of consumer acceptability and nutritive value of the products.

Comprehensive information of this kind is needed for the long-range improvement of fruit and vegetable raw materials for processing, raw material storage and handling practices, processing and packaging methods, and finished-product storage and distribution practices. Research workers are beginning to clear up the enormously complex organization of fruit and vegetable plant materials through the application of entirely new laboratory techniques. The opportunity to expand this kind of knowledge should be exploited vigorously, because it is already apparent that even minute quantities of some constituents have a profound effect on the stability and acceptability of the processed products.

IV. FOOD CONSUMPTION AND DIETARY LEVELS

A. PROGRESS ON WORK UNDER WAY

1. National Food Supply

a. Trends in Food Consumption

SHR

The bulletin on analysis of changes in food expenditures, 1929-54, was not published in 1955 in order to permit further reconciliation of Department of Commerce and Department of Agriculture data. The material is now being reviewed to bring data to date and to develop further certain points for publication late this fall.

b. Consumption of Processed Foods

SHR

The study of the current pattern of the consumption of processed foods and relating current data to historical series and socio-economic information has been retarded by delays in issuance of reports from the 1954 censuses and the 1955 Survey of Household Food Consumption. But it is hoped that the work can proceed rather rapidly during the winter so that a report can be written next spring.

c. Studies for the Congress of possibilities of a food stamp plan and of strategic stockpiling of foodstuffs.

AMS-ARS

Title II Sec. 201 of the Agriculture Act of 1956 required the Secretary to submit to the Congress before September 1 detailed programs needed for surplus disposal, including (1) a food stamp plan or similar program for distribution of future surpluses; and (2) the strategic stockpiling of foodstuffs. Departmental groups are working on these requests and their progress will be reported orally at the meeting of the Food and Nutrition Advisory Committee.

d. Marketing Studies on Economic Loss and Waste

MOC

As part of the 1955-56 studies on marketing margins and costs, data were obtained on losses of bones and fat, and weight shrinkage of beef and pork carcasses between farm and retail level. Some information on losses will be available from the fluid milk and egg marketing studies currently under way.

Plans:

- (1) Supplements for the bulletins on supply-utilization of farm commodities (A.H. #91) and on food consumption (A.H. #62) will be prepared as soon as data from the 1954 censuses are available, with objective of publication in mid-1957.

- (2) One phase of the work on revision of consumption data is the review and probable reworking of the present rough estimates of consumption of home produced foods. This will incorporate data obtained from the 1955 Survey of Household Food Consumption.
- (3) When data from the 1955 Survey of Household Food Consumption and the 1956 Survey of In-Plant Feeding are available, work will begin on a new type of analysis of changes in food consumption. It will be based on the development of statistical models of food consumption patterns combining survey data, marketing information, and historical data on related major economic and social factors affecting food use through time and in major regions of the country.

Publications:

"Supplement for 1954 to Consumption of Food in the United States, 1909-52." USDA Agriculture Handbook No. 62 Oct. 1955.

"Measuring the Supply and Utilization of Farm Commodities." USDA Agriculture Handbook No. 91, Nov. 1955.

"Marketing Costs for Food." USDA Miscellaneous Publication No. 703, December 1955.

"Beef Marketing Margins and Costs," USDA Miscellaneous Publication No. 710, Feb. 1956.

"Marketing Margins for White Bread," USDA Miscellaneous Publication No. 712, March 1956.

"Pork Marketing Margins and Costs," USDA Miscellaneous Publication No. 711, April 1956.

2. Household Food Consumption

a. 1955 Food Consumption Survey

HHE

MD

SHR

The data on food consumption obtained from the 5,000 households included in the 1955 survey have been prepared for tabulation, and a preliminary report has been completed. This is the first nationwide study of food consumption since 1942 that covers rural as well as urban households.

The preliminary tables from this survey indicate that food expenditures of housekeeping families in the U. S. averaged \$27 a week in the spring of 1955. About \$22 of this was for food consumed at home. The remainder, \$5, was spent for meals and between-meal food away from home. With average size of the household at 3.43 persons, average expenditure per person amounted to \$7.89 a week for all food. Of this \$5.50 was spent for food to be prepared at home, and \$1.39 for food consumed away from home. The tables included in this report

also make possible comparison of rural and urban, regional, and income groups as to family food expenditures.

The food expenditure increase since the previous nationwide survey in 1942 indicates the effect of both higher food prices and the use of more expensive foods. In 1955, average food expenditure was about three times the average of \$10 in 1942. A more precise comparison can be made for urban families of two or more persons. They spent \$13 in 1942, \$26 in 1948, and \$32 in 1955. Food prices as measured by the Bureau of Labor Statistics' index advanced only 6.5 percent between 1948 and 1955. The fact that family food expenditures increased about 25 percent indicates what is sometimes referred to as "up-grading" of the diet -- either use of more expensive types of foods or inclusion of more services, such as precooking of foods, in the foods purchased.

MD has work under way to determine the relationship between consumption and income of major foods and groups of foods based on individual family observations from this study. Household size as well as income is being taken into account in measuring the relationships. It is expected that this information will be useful to market analysts and others investigating patterns of food consumption for the purpose of devising programs for promoting consumption of certain food products and as an aid in developing legislative programs for subsidized consumption among low income families of agricultural products in surplus supply.

Plans: Five sets of initial reports are to be prepared and all are to be included in one Department publication series. These five are Food Consumption of Households; Dietary Levels; Home Food Preservation Practices; Home Food Production; and Home Baking Practices. Plans have been made for first releases in this series beginning late in 1956. In all reports, separate data will be shown by family income class for each region and the U. S. for rural farm, rural nonfarm, urban, nonfarm (rural nonfarm and urban), and all urbanizations combined. In the processing of these data, the work has been planned to make the working materials (listings, punch cards, and tapes) as useful as possible also for later research that will require additional tabulations.

As soon as possible after the reports with basic data are issued, analytical and descriptive reports will be prepared by the agencies cooperating on this project.

IHE will prepare materials on dietary adequacy, the relative economy of foods, the place of various foods in the household budget, and a study of the effect of various factors on household food practices as shown by the proportion of expenditures for food away from home, the types of foods purchased for use at home and the types and quantities of foods produced, preserved, and baked at home, with regional-urbanization comparisons and trends over time.

SHR will prepare (1) a series of descriptive articles for the National Food Situation, (2) a series of commodity reports comparing the findings of this survey with those of other surveys, and with time series and other marketing data, and (3) a series of analytical cross-commodity reports, not yet outlined in detail.

MD anticipates that a report covering its phase of this work will be issued this fiscal year.

b. Food Consumption and Dietary Levels of Rural Families

HHE

Food consumption and dietary levels of rural families in the North Central region have been investigated as a basis for educational programs of teachers, nutritionists and extension workers and for policy and program decisions of USDA administrators and others interested in levels of living of rural families. The data were collected from a sample of 1,152 families in 1952. A report prepared for publication during the year summarizes the information on quantities and expenditures for food used during a week, the amounts that were purchased or home-produced, the nutritive content of the week's food and the variations in these respects among different groups of families. Some of the findings are summarized below.

Of every dollar spent for purchased food by the farm family, 22 cents went for meat, poultry, and fish, 20 cents for fruits and vegetables (including potatoes), 10 cents each for milk, baked goods, and beverages, 6 cents for fats and oils, and the remainder for sugar, flour, cereals, eggs and other foods. By contrast, 40 cents of every dollar's worth of home-produced food represented meat, poultry, and fish, 25 cents milk, 20 cents fruits and vegetables, 7 cents eggs, and only 3 cents for all other foods combined.

Tabulations of these data for families with and without facilities for freezing and storing frozen food show the chief difference to be the larger amounts of food used by families with freezing facilities. Farm families with freezers or lockers used food in a week valued at retail prices of \$7.26 per person, with 46 percent home-produced. The food they bought came to \$3.76 per person. By contrast farm families without freezers or lockers had only 37 percent of their food (in money value) from the home farm. Their total food for the week had a retail value of \$6.72 per person, \$4.14 of which was purchased. Thus, the farm families with freezing facilities produced more food for themselves and had more total food with less direct money outlay. They used more meat per person than families without freezing facilities. Although the families with freezing facilities used a little more frozen fruits and vegetables per person, frozen had not displaced fresh and canned products. Those with freezing facilities used nearly the same amount canned and as much or more fresh as those with no facilities.

On the average, the food used at home by rural families in the North Central region provided diets exceeding the National Research Council's recommended allowances for calories and 8 nutrients studied, with the farm diets having larger amounts in relation to estimated need than the nonfarm. However, a number of families had diets low in one or more nutrients. One-fourth of both the farm and rural nonfarm diets fell below the NRC allowance for ascorbic acid; one-fifth of the farm and one-third of the nonfarm diets failed to meet the allowance for calcium. One-fourth of the nonfarm families were below the recommended level for thiamine and a fifth for vitamin A, riboflavin, or niacin.

In general, farm families had more food per person than nonfarm families, more than enough to make up for the greater food needs of farm households resulting from differences in degree of physical activity. One reason for this was the large amounts of home-produced food, particularly animal products, used by farm families. Most farm families in the North Central region produced milk, meat, or eggs for their own use, and families producing these foods consumed more of them than those depending solely on purchases.

Families with older homemakers were likely to have poorer diets than those with younger homemakers. Especially when the family income was under \$2,000, older rural nonfarm families were likely to have diets that could well be improved. In this low-income group, 30 percent of the families with a homemaker aged 60 years or more had food in a week providing less than recommended amounts of protein, 46 percent of ascorbic acid, and 65 percent, of calcium. While some younger families with this low an income also had diets below nutritionally desirable goals, the older families were considerably more likely to do so. These older low-income families are a significant group in the population. More than half of all the older rural nonfarm families (that is, families with a homemaker aged 60 or more) in the North Central region had an income below \$2,000 for the year.

Further analysis of the data from this survey indicated that the larger the amounts spent on food (or the higher the total money value), the greater the likelihood that the foods consumed provided an adequate diet, but spending a large amount by no means assured attaining dietary adequacy. Even at high incomes a number of families had less than recommended amounts of important nutrients. No single pattern of food selection in itself always resulted in a good diet or in a poor diet. However, in a comparison of diets rated good and those rated poor, the diets classed as good generally included larger quantities per person of fruits and vegetables, milk products, and somewhat more meat, poultry, fish, and eggs.

Plans: The two bulletins on this survey (the first was reported last year) complete the presentation of the basic data. Attention will be directed next toward estimating and interpreting trends in farm family food consumption.

c. Food Consumption and Losses in Four Institutions

HHE

Very little has been known about the amount of food lost during preparation, cooking, service, and as plate waste in institutions. Yet if this loss is high, diets may not be nutritionally adequate and the cost of food will be unnecessarily great.

To acquire some information on what food issues and food losses are, the cooperation of 4 institutions -- 2 homes for aged and 2 for children -- was obtained. In one children's home, the food was prepared and served in individual cottages with 15 children to a cottage. The other three institutions served from 90 to 304 persons. In each institution, food coming into the kitchen, the amount discarded during preparation and service, and the amount left on plates was weighed to find out how much was eaten. Then nutritive values and costs were calculated.

The institutions tended to divide their dollars among food groups much as families do. The "milk, cream, cheese, ice cream" and "meat, poultry, fish" groups together made up about half of the institutions' food budgets; this is a little more than what families spend for these items. The children's homes included slightly more milk.

The money value of food coming into the institution kitchen ranged from 56 to 83 cents per person per day. When adjusted for differences in calorie needs of the residents, three of the four had similar food costs. In these institutions, the money value per person of the food issued was approximately the same as or lower than that of food of low-income families in cities in the same region. The fourth institution, an institution for aged persons in the South, had considerably higher food costs. These values included donated foods, especially milk, which were used by all four institutions. Two institutions augmented their supplies by home producing milk and some pork and vegetables.

The amount of food lost, especially as plate waste, in the three large institutions is much larger than in a family situation. It amounted in value to 12 to 22 cents a person a day and is probably characteristic of many institutions of similar size and category. On the other hand, in the children's cottage food losses ran less than 4 cents per child and probably are similar to food losses in a large family where the food budget is small and plate waste held at a minimum.

When the average nutritive values of the foods as received were compared with the 1948 Recommended Dietary Allowances, all institutions were found to have adequate food supplies. When food losses were deducted, however, the food eaten in the two old-age institutions was low or border-line for several nutrients; iron in both institutions, vitamin A and niacin in one, and ascorbic acid in the other. The children's institution did better in meeting the allowances.

Plans: Publication of two articles completes current work in this area. The data will also be used by USDA food economists in assessing the adequacy of institutional diets and in formulating food plans. It has not been possible to initiate any new work in food losses in homes or institutions during the past year. (See Proposal "A" following this section.)

Publications:

HHE

"Food Expenditures of Households in the United States" Preliminary Report, Household Food Consumption, 1955, July 1956.

"Food Consumption and Dietary Levels, Rural Families in the North Central Region, 1952." M. Orshansky, C. LeBovitz, E. C. Blake, and M. A. Moss, AIB ___, 1956.

"Food Preservation Practices and Relation to Income and Size of Family." Mollie Orshansky, Rural Family Living, November 1955.

"Food Preservation Practices and Relation to Age and Education of Homemaker." Millie Orshansky, Rural Family Living, November 1955.

"Effect of Food Losses on Nutritive Content of Diets in Four Institutions." Constance L. Brine and Edith B. Tate, Jour. Amer. Dietet. Assoc. 32, January 1956.

"Food Expenditures in Four Institutions," Faith Clark and Edith B. Tate, Jour. Amer. Dietet. Assoc., September 1956.

"Nutritive Values of Per Capita Food Supply," table and Nutritional Review in National Food Situation, October 1955.

"Nutrients Contributed by Major Food Groups--A Reflection of Changing Food Habits." Eloise Cofer, National Food Situation, October 1955.

3. Diet Appraisal

a. Basic Data for Food and Nutrition Programs

HHE

Research findings from several projects have been used in the development of a publication, Essentials of an Adequate Diet, released in June, 1956. The most recent research on human nutritional needs (expressed in terms of recommended dietary allowances), nutritive value of foods, and food consumption habits provides the basis of the recommendations contained in the bulletin. Special emphasis has been given to the nutrients most likely to be short in American diets, and to foods that are good sources of these nutrients. Because different kinds of foods can provide the essential nutrients and because food supplies in this country are ample to provide considerable freedom of choice, the bulletin presents a point system to show how common foods rate as sources of key nutrients.

Using this system, foods within the basic plan can be interchanged to allow for differences in availability and cost of foods, food preferences, and other factors. This publication was designed as a source book for nutritionists, extension workers and others who are teaching the principles of good food selection. It is the first of a series, Facts for Nutrition Programs, designed to meet the continuing demand for authentic information on food values, diets, and other subjects related to nutrition.

Plans: Include expansion of this series to cover additional topics and cooperation with information and education specialists in the preparation of popular materials and teaching aids to present the information contained in "Essentials of an Adequate Diet."

b. Facts for Consumer Education

HHE

Another series of publications, Facts for Consumer Education, presents basic research material, by commodity, on consumer buying, nutritive values and use of foods, for use in consumer information and marketing programs. This series has now covered the following foods: Beef, pork, tomatoes, peaches, milk and milk products, and bread. The publication on bread which was issued during the year was especially well received. The publication shows the many-sided contribution that grain products make to a nutritionally adequate diet. For example, 5 slices of bread provide over 15 percent of the recommended dietary allowances for protein, thiamine, iron, niacin and about a tenth of the calcium, riboflavin, and food energy needs of a 25-year old man. The bulletin also shows the economy of bread as a source of 6 important nutrients.

Plans: A publication on potatoes has been submitted for review. At present no additions to the series are planned.

c. Composition and Nutritive Value of Foods

HHE

Continuing work is required to prepare and keep up-to-date suitable tables of the composition and nutritive value of foods. One of the segments completed during the year was a Handbook on physical yields and losses or changes that occur in food preparation. Information has been brought together from many laboratories on how much meat, fruits, vegetables and other foods purchased on the market can be expected to yield as food ready to eat. The publication "Food yields--summarized by different stages of preparation" gives dietitians and food managers as up-to-date guide for planning food purchases for school lunch rooms, hotels, restaurants, the armed forces, hospitals, and other institutions. The data take account of present-day practices in processing and marketing food and new developments in breeding plants and livestock that affect yields not reflected in earlier less comprehensive summaries of yield data.

Preliminary tables of amino acid content of food were issued in small edition for study and review. Copies were made available to the FAO Committee on Protein Requirements which met in Rome in October 1955. The tables included values for 12 amino acids for over 300 food items. This is the first comprehensive table of average values available for calculating the amino acid content of diets or food supplies. In preparation for publication, data for 6 more amino acids and several additional food items are included.

Progress is being made in establishing channels for securing unpublished analytical data to use in a contemplated revision of Handbook C, "Composition of Foods, Raw, Processed, Prepared." Increasing appreciation of the scope and usefulness of this research has resulted in continuing requests from individuals, business and Government organizations for information on composition and nutritive value of foods. In the past year these have come from the Pan American Union, Department of the Army, Veterans' Administration, the Fish and Wildlife Service, as well as from several agencies in the USDA.

Plans: Tables of amino acid content of foods will be completed for publication. Compilation and review of data will be continued in preparation for revision of Handbook C - "Composition of Foods -- Raw, Processed, Prepared."

d. Contribution to Food and Nutrition Programs

HHE

Nutrition Committee News, issued bi-monthly to members of State Nutrition Committees and other nutrition workers, has continued to summarize and interpret research findings and to promote exchange of information about nutrition activities. Included during the year was a round-up of nutrition activities of public health agencies, prepared by nutritionists in the Public Health Service and Children's Bureau of the Department of Health, Education and Welfare; a summary of progress in the school lunch and school milk programs, prepared by the Food Distribution Division of the Agricultural Marketing Service; and a history of West Virginia's State Nutrition Council prepared by members of that group. One issue covered research reporting on diets and nutritional health of adults. For another issue programs of the Nutrition Committees designed to promote improvement were described and summarized.

Another contribution to nutrition programs is a publication describing briefly the nutrition education and school lunch activities of Federal agencies, as well as the American National Red Cross and the Food and Agricultural Organization of the United Nations. Issued by ARS in May 1956, this pamphlet was prepared by the Interagency Committee on Nutrition Education and the School Lunch for use with students and out-of-country visitors as a guide to sources of information on nutrition education and school lunch.

Plans: The activities of the Nutrition Programs Service will be continued. Plans are being developed for a Nutrition Institute during 1957, to be sponsored by the Department of Agriculture and other agencies concerned with nutrition and nutrition education.

Publications:

HHE

"Essentials of an Adequate Diet--Facts for Nutrition Programs," by L. Page and E. F. Phipard, ARS 62-4, June 1956.

"Diet and Serum Cholesterol in Men: Lack of Effect of Dietary Cholesterol," A. Keys, J. T. Anderson, O. Michelsen, S. F. Adelson, and F. Fidanza. Jour. Nutr. 59(1) 39-56, May 1956.

"Bread, Facts for Consumer Education," by I. H. Wolgamot and L. J. Fincher, AIB 142, November 1955.

"Food Yields, Summarized by Different Stages of Preparation," by R. Pecot and B. K. Watt, AH 102, July 1956.

Issues of Nutrition Committee News

"Cooperation Sparks Success in School Lunch, School Milk, July-August 1955."

"Nutrition Programs of Public Health Agencies, September-October 1955."

"Adult Nutrition I. The Situation, Winter 1955-56, November-February."

"The History of West Virginia's State Nutrition Council, March-April 1956."

"Adult Nutrition II. Practical, Popular Nutrition Programs, May-June 1956."

"Nutrition Education and School Lunch Activities of Agencies Represented on the Interagency Committee on Nutrition Education and School Lunch," prepared by the Interagency Committee. ARS 62-3, May 1956.

4. Food Purchases and Preferences

a. Industrial Feeding Facilities

MCC
MD

This cooperative MD-MCC study is designed to measure the amounts and kinds of foods absorbed by food facilities provided for employees by industrial plants, and to learn management evaluations of the usefulness and importance of these food facilities. Data for this nationwide survey of industrial

food services were collected in January-February 1956. Included is information on where these facilities buy their food, how they buy, how much and what kind of food they use, and to what extent they use commercially added services.

Plans: The data are being tabulated and present plans call for releases of several preliminary reports, the first of which is expected to be available by mid 1957.

b. Food Marketing Margins and Costs

MOC

A series of studies is under way that deal with the cost of marketing various foods. Some of these relate to the measurement of marketing margins, some are concerned with the analysis of marketing costs and others center on the effects of marketing practices on margins and costs. In each of these, some attention is given to where the consumer's dollar goes. For example, in the study, "Marketing Margins for White Bread," it is shown that in 1955, of the 17.7 cents consumers paid for a loaf of white bread, 3.1 cents (18%) went to the farmer; 1.9 cents (11%) to the miller; 9.8 cents, (55%) to the baker; and, 2.9 cents (16%) to the retailer. Also shown is the trend in such data since 1946.

Plans: Other studies under way include those on marketing margins for cheese, butter, fluid milk, and eggs.

c. Patterns in Meat Distribution in the Oakland-San Francisco Bay Area, 1955

MOC

A study was made of the distribution of fresh beef, veal, and lamb, and fresh and cured pork through the various wholesale and retail outlets in the Oakland-San Francisco Bay area. Based on carcass weight, information collected showed that about 20 percent of these meats was consumed away from home. Of the remainder, which was consumed at home, about 20 percent was bought in retail food chain stores and the balance purchased at meat markets and independent grocery stores.

According to this study, per capita consumption on the Bay area of all fresh meat and cured pork is low compared with the average level for the Nation as a whole. On the other hand, consumption of poultry and fish is relatively high.

d. Institutional Market Potential for Oilseed Products

MD

Research was done to appraise the market potential for oilseed products in public and private institutional outlets. To provide a basis for a more adequate appraisal of the institutional market, the study was directed at determining: the kinds and quantities of protein sources used in institutional diets; the economic and nutritional importance of protein sources as a part of the diet of institutional inmates; the adequacy of the level of other nutrients in the diet; and the economic and

nutritional effect of supplementing institutional food supplies with an inexpensive protein material such as oilseed products.

Plans: The data collected in this study have been analyzed, and a manuscript has been submitted for clearance.

e. Effect of Coupons and "Special Offers" on the Sales of Food Fats and Oils at the Retail Level

MD

Consumer purchase data from a sample of 500 panel families in Chicago, Illinois, are being studied to ascertain the effects of coupons and "special offers" on the volume of sales of food fats and oils at the retail level. The consumer panel data cover the period July 1, 1953, through June 30, 1955. These data include details as to family purchases of each of the four products -- butter, margarine, shortening, and cooking oils -- by date of purchase, brand purchased, quantity purchased, price paid, and whether any coupons or "special offers" were involved in the transaction.

Plans: The analysis of the data has begun, and it is anticipated that a published report will be available about the latter part of the fiscal year 1957.

f. School Milk Program Evaluations

MD

Studies are currently underway in St. Louis and Los Angeles to determine and evaluate the effects of certain factors on milk consumption in elementary schools and high schools. The factors being studied include price, availability, size of serving units, income and educational level of parents, size of school, grade level of students, and the availability of chocolate drink.

Preliminary findings show milk consumption in St. Louis elementary schools with lunchrooms to be up by 200 percent during September-November 1955 compared with a year earlier (exclusive of milk served with Type A lunches). This increase was associated with a 60 percent reduction in price made possible by the Special School Milk Program and additional times of service in most schools. In elementary schools with milk stations the increase in milk consumption during these months was 125 percent while the price was down 50 percent.

In Los Angeles city schools milk consumption was up 110 percent in September-November 1955 with larger containers and when the price was reduced 21 percent in elementary schools and 53 percent in high schools.

Plans: Reports of these studies of milk consumption during the 1955-56 and the 1954-55 school years will be published during fiscal 1957. It is anticipated that this work will be expanded

to obtain on a national basis comparative data on milk consumption between schools participating and schools not participating in the Special School Milk Program. Information for this study will be obtained through a nation-wide survey of feeding programs in elementary and secondary schools.

g. School Lunch Program Evaluations

MD

A study relating to feeding programs in elementary and secondary schools throughout the nation is being initiated. It will be the objective of this study to determine: (1) The extent of school feeding programs in the United States and student participation therein and (2) reasons for participation and non-participation of schools and children in the National School Lunch Program.

Plans: It is anticipated that collection of data for this study will begin early in 1957 and results will be published in the latter part of that year.

h. Household Purchases of Dairy Products

MD

From April 1954 through March 1956, monthly data on household purchases, prices paid, and related information for butter, cheese, nonfat dry milk solids, and margarine were obtained from the National Consumer Panel of the Market Research Corporation of America. Starting in April 1956, the coverage was changed to include reporting on household purchases of fluid whole milk and fluid skim items, with the butter data being continued. The information on fluid milk includes purchases by container size. The reports are financed jointly by the USDA and the dairy industry through the American Dairy Association. Quarterly reports carry breakdowns by regions and type of retail sales outlets. The annual report relates household purchases to family characteristics such as income and size of family.

Plans: It is anticipated that this work will be continued at the same level through March 1957.

i. Consumer Purchases of Fruits and Juices

MD

The survey of household purchases and prices paid for citrus fruit and products and their availability in retail stores has been continued in the past year. Monthly reports are published, providing national estimates of volume of purchases by householders, average prices paid, percentage of families buying, and frequency and average size of purchase. Quarterly reports present information by region and type of retail outlet. An annual summary of these data is made by family characteristics--income, occupation, and education of family head, size of family, presence of children, and age of housewife. In February and August audits are made of

a national sample of retail food stores to determine the availability of citrus fruit and selected products by type and size of store and by geographic region. Half the funds for these data are provided by citrus industry groups.

Plans: It is expected this work will continue through the next year.

j. Consumer Acceptance and Preference Studies

MD

(1) Preferences for canned grapefruit juices

Research aimed at determining consumers' preferences for canned grapefruit juices that vary in Brix-acid ratio (with degrees Brix constant), natural-flavor vs. sugar-added, and unlabeled vs. labeled juices ("sweetened" -- "unsweetened") was completed and a final report was published in December 1955.

Some of the major findings were that the labeled juices, whether labeled "sweetened" or "unsweetened," received higher preference than unlabeled juices; the sweetened juices received higher preference ratings than the unsweetened juices; within the unsweetened juices at 7, 9, 11, and 13 Brix-acid ratio levels, the juice at 7 Brix-acid ratio was least preferred. There were no significant differences in the ratings for the natural-flavored juices at 9, 11, and 13 Brix-acid ratios; within the sweetened juices at 9, 11, 13, and 15 Brix-acid ratio levels there were no significant differences in the preference ratings.

The results indicate that producers can best meet general consumers' preferences for canned grapefruit juices by marketing sweetened juices at from 9 to 15 Brix-acid ratio when Brix is at 11.6 to 12.6. Labeling the juice "sugar added" or "sweetened" could serve to enhance favorableness of reaction to the juices. Natural flavored canned grapefruit juice should be marketed from 9 to 13 Brix-acid ratio when degrees Brix is at 10.

(2) Consumer acceptance of frozen grapefruit sections

This study was planned to assist the citrus industry in determining whether commercial processing of the product would be feasible from the standpoint of consumer acceptance and reactions to the product after use. The product was market tested in Erie, Pa. The major findings of the consumer survey were that more than 1 in every 10 home-makers had bought frozen grapefruit sections; about half were aware of the new product; more than 8 in every 10 who witnessed a demonstration of the product in the stores stated that they made initial purchases immediately after;

although the majority were satisfied with the product, a small but significant percentage thought the product too sweet; most respondents would have preferred a size larger than the 10 ounce can.

(3) Consumer preferences for white pan bread

The field phase of the research on determining consumer preferences for white pan bread in respect to specific volume, content of lard, sucrose, and nonfat milk solids was completed in June 1955. The analysis of the data was completed during the summer of 1955 and the final report was published in May 1956.

Some of the major findings are that increasing specific volume from 7 to 10 cubic inches per ounce resulted in a significant increase in preference for the bread; increasing the sucrose content from 2 to 7 percent resulted in a significant increase in preference; inclusion of 4 percent of nonfat milk solids increased the preference for the bread significantly as compared with bread having no milk solids. A further increase in content to 8 percent did not have a significant effect; increasing the lard content from 3 to 5 percent did not significantly affect preference.

(4) Consumer use of and opinions about different kinds of pies and uses of canned and frozen cherries in pie baking

This research project was undertaken in cooperation with the National Red Cherry Institute and was designed to provide background information about homemakers who bake pies, with special reference to those who bake cherry pies. Final results have been published.

Some of the major findings were that some 4 in 5 homemakers in each of the 3 cities surveyed -- Dallas, Detroit and Kansas City -- had baked a pie within the past year; apple pie was baked by more homemakers -- 30 percent -- than any other pie. More than half had baked a cherry pie within the past year; the "tart, tangy taste" of the cherry pie and the "family's asking for it because we like it" were frequent reasons given for baking cherry pie. Other replies included "cherry flavor," "variety -- something different," and "pretty, looks good to eat -- we like the red color;" few homemakers in each city had used red sour cherries in any form for some purpose other than as a pie filling.

(5) Consumer use of and preferences for peanuts and tree nuts

The purposes of this study were to measure the extent to which peanut and tree nut products are used in households and to determine what attitudes, opinions and other factors

influence consumption of these products by household consumers. A report of this research is being prepared.

(6) Consumers' attitudes and opinions toward packaging of
canned and frozen foods

This study was undertaken to determine consumers' attitudes and opinions toward existing retail package sizes for frozen and canned foods, use of and opinions about labeling data and problems associated with home storage. The data are now being processed.

(7) Consumer preferences, usages and buying priorities
for poultry and poultry products

The study was planned to determine housewives' present use of poultry products and the ways in which they are used. Motivating factors causing use or nonuse of poultry products will be ascertained. Data were collected during the summer of 1956.

(8) Consumer acceptance of frozen fresh cranberries

The purpose of this study was to ascertain consumers' attitudes toward the use of frozen fresh cranberries. Marketing cranberries in this form, if feasible, would lengthen the marketing season for the product and materially reduce losses in weight and volume that result from shrinkage. The study was conducted in Minneapolis-St. Paul among purchasers of the product in cooperation with the Farmer Cooperative Service. A final report is expected in 1957.

(9) Opinions about the use of citrus products, avocados, dates,
and raisins

Planning is underway on a survey of opinions about and use of citrus products, avocados, dates and raisins. In many respects, this survey is intended to be a followup of the Department's "Consumers' Use of and Opinions about Citrus Products," Agricultural Information Bulletin No. 50, which was published in 1950, with additional information on sub-fruits -- avocados, dates, and raisins -- and on those proposed citrus products not available to the public in 1950.

It is planned that this survey will be conducted under contract with a private market research firm and the interviewing is tentatively scheduled for the winter of 1956-57.

(10) Restaurant acceptance of dehydrofrozen peas

Work is now under way in Milwaukee to determine the commercial possibilities for dehydrofrozen peas (a new product developed by WU) in a segment of the institutional market, including public eating places such as hotels, restaurants, cafeterias, etc. A week's supply of dehydrofrozen peas is being made available to a representative sample of 100 restaurant owners and operators in the test city to try out in their own kitchens. A WU representative will assist each restaurant operator in preparing the first batch of dehydrofrozen peas and will make observations of the characteristics of these dehydrofrozen peas in relation to handling, cooking, and serving. After a week's experience with the product, each of the restaurant owners and/or managers will be interviewed to determine their own attitudes and opinions toward dehydrofrozen peas as well as customer reaction. If acceptable to users, dehydrofrozen peas offer a number of advantages, particularly with regard to savings in storage and transportation.

The work on dehydrofrozen peas is a segment of this Branch's cooperative research with the Utilization Research Branches of ARS.

Plans: A successful pretest was conducted in San Francisco, California, in July 1956. The full field test is expected to be completed in October 1956. A final report should be available in 1957.

(11) Market test and consumer acceptance of potato flakes

This work was initiated in March 1956 at the request of EU, the developers of potato flakes, a new form of dehydrated mashed potatoes. Lower solid-content potatoes can now be converted into a form of dehydrated mashed potatoes by an economically sound process. This process provides a new consumer market for potatoes in processed form.

Potato flakes appeared to be a satisfactory product having the essential requirements--appearance, flavor, and texture--needed in a good mashed potato. The product also fitted into the present trend of convenience food for the homemaker. Thus, it was decided that a market test of the product was needed to determine its acceptance in an actual market situation as a prerequisite for commercial production. Cooperating with the Department on this market test are the Maine Potato Commission, the Maine State Department of Agriculture, and the Maine Agricultural Experiment Station. EU processed into potato flakes a carload of Maine russet potatoes furnished by the Maine Potato Commission. Enough flakes were produced to fill 23,000 4-serving boxes. The

box design was a task carried out by the Maine State Department of Agriculture. The Maine State Department of Agriculture also furnished two merchandising specialists to distribute the product in the test stores in the test market. Funds for the advertising and promotional campaign necessary to carry out the market test were contributed by the Maine Potato Commission.

Cooperation was procured with all the chain and leading independent stores in the test market area. These stores represented almost 80 percent of the retail food sales in the test area. Consumer acceptance of the product was determined by household survey of the area in which homemakers were interviewed on their reactions to this new product.

Plans: The audit of sales and consumer survey phase of the market test has been completed in the tri-city area of Binghamton, Endicott, and Johnson City, New York. Analysis of the data collected is now under way. It is anticipated that a final report will be available in 1956-57.

(12) Consumer use of and preferences for selected cuts of lamb

This study had a twofold objective -- to evaluate consumer preferences for and attitudes toward fresh lamb; and to measure the effects of promotion at the consumer level in terms of changes in both overall and specific use of lamb, as well as changes in attitudes and opinions. The surveys were conducted in Cleveland, Ohio and Sacramento, California, in conjunction with retail store audits to measure changes in volume and price.

A report of the Cleveland study covering the first objective was published in March 1956. Some of the more important findings are: Almost 5 in 10 homemakers in the Cleveland area used lamb in the preceding year and approximately 1 in 6 bought lamb during the week preceding the interview.

Users liked lamb because of its distinctive flavor, its nutritive qualities, its lean tender texture, the ease of preparation, and the variety it adds to meals.

Users disliked lamb because of its cost, tough greasy texture, strong flavor, and its odor during cooking.

Preferred cuts of lamb were chops and leg of lamb.

Nonusers mentioned dislike of flavor and eating habits developed in childhood as important reasons for not using lamb.

Plans: The Sacramento study covering the first phase has also been completed and will be published as soon as results of the second phase, which are now being processed, become

available. The second phase of the Cleveland study will be conducted in the fall of 1956.

Publications:

MD

"Market Development Research Relating to Lamb and Wool," Harry O. Doty, Jr., prepared for the Agricultural Outlook Conference, Nov. 29, 1955.

"Section 708 of the National Wool Act of 1954--Provisions and the Operations to Date," Harry O. Doty, Jr., prepared for the Agricultural Outlook Conference, Nov. 29, 1955.

"Distribution of Lamb and Mutton for Consumption in the U. S.," Harry O. Doty, Jr., AIS-93, February 1956.

"Lamb and Mutton Consumption in U. S.," Harry O. Doty, Jr., Marketing Activities, March 1956, p. 8.

"Mary's Lamb Followed Her--But Where Do Your Lambs Go?", Harry O. Doty, Jr., Daniel B. Levine, and J. Scott Hunter, Agricultural Situation, Vol. 40, No. 4, April 1956, p. 26.

"Lamb Consumption by States," Harry O. Doty, Jr., The Livestock and Meat Situation - 83, May 9, 1956, p. 26.

"Homemakers' Preferences for Selected Cuts of Lamb in Cleveland, Ohio," Daniel B. Levine and J. Scott Hunter, USDA Marketing Research Report No. 113, March 1956.

"Preferences for Canned Grapefruit Juices," Hugh P. Bell, Marketing Research Report No. 103, December 1955.

"Frozen Grapefruit Sections: Evaluating a New Product by Retail Sales Audit and Household Survey," Robert E. Branson, Milton Jacobs, and Richard Hall, Marketing Research Report No. 110, December 1955.

"Consumers' Preferences among Bakers' White Breads of Different Formulas, A Survey in Rockford, Ill.," Hugh P. Bell, Marketing Research Report No. 113, May 1956.

"Homemaker Preferences for Pies and Canned and Frozen Cherries," Daniel B. Levine, Marketing Research Report No. 116, April 1956.

B. PROPOSALS FOR COMMITTEE CONSIDERATION ON
IV. FOOD CONSUMPTION AND DIETARY LEVELS

(Order of listing has no priority significance)

- A. Adjusted Estimates of Nutritive Value of Food Supplies -- Initiate research to adjust estimates of nutritive value of national and family food supplies, by making deductions for food waste in consuming groups for use in Department programs and in nutrition education.

Statistics on the nutritive value of national and family food supplies are widely used in Department programs such as those of ARS, AMS and the Cooperative Extension Service, and also by the public as an indication of dietary adequacy in the United States. Available statistics, however, are for food used in an economic sense (i.e., as it enters the kitchen) and do not provide a measure of the amounts of food eaten. Lack of information on the extent of the gap between estimates of nutrients in food supplies and the amounts actually consumed raises important questions in interpretation of findings as to the nutritive content of diets in this country. Data on food losses as they affect dietary adequacy are needed for nutrition education programs. For example, discussion of the increasing amount and changes in the kind of fat in the national diet, a matter of current concern to nutritionists, has emphasized the need for information on the extent of food losses in homes, restaurants and institutions. Moreover, judgments as to the potential market for foods in terms of dietary improvement could be markedly altered if statistics were available on the amounts of food actually consumed. Almost no data are now available from which to make any kind of estimate of household food losses. Although the staff recognizes the importance of this problem, it has not been possible within the current program to initiate the broad attack on this problem that would be needed to produce meaningful results.

- B. Food Composition Tables -- Expand research to increase the scope of tables of composition and nutritive value of foods.

The tables of food composition published by the U. S. Department of Agriculture at intervals since 1896 are the basic source of data on nutritive value of foods and are used throughout the country in appraising the place of foods in diets and for food planning. They are widely reproduced in textbooks used in nutrition teaching. Practical applications in the Department include evaluating the nutrient content of foods for dietary surveys, the per capita food supply and for the school lunch program, and in providing consumer information for nutrition education and marketing programs. The basic tables must be revised at intervals to include new laboratory data on the nutritive value of foods and to keep abreast

of new foods and changes in foods available on the market. A limited revision of the basic handbook has been initiated, but because of the large number of new foods on the market and the wealth of new data among public and private laboratories throughout the country, it is not possible to cover the field adequately without an expanded program. The expanded program would make it possible to increase the number of foods and varieties of foods covered, to increase the number of nutrients for which data will be summarized.

- C. Facts for Nutrition Programs -- Expand the series "Facts for Nutrition programs" to include research findings on food and nutrition that will be useful in nutrition programs.

The first publication in this series, "Essentials of an Adequate Diet," has made research findings available on which to base popular releases, visual material and nutrition education programs. Additional topics that should be covered are: The relative economy of various types of foods as sources of nutrients; food in relation to weight control; food fads and misinformation; and information about food processing, food handling practices, and additives as they affect the wholesomeness and nutritive value of foods.

- D. Food Consumption of Family Members -- Initiate research on food consumption and nutrients content of diets of individuals to determine differences among age groups and the contribution to the total diet of foods consumed away from home.

Knowledge of food consumption of individuals of different age groups will contribute to the understanding and forecasting of changes in food needs and consumption as the age distribution of the population changes. This study would add to our very meager knowledge of the kinds and quantities of food consumed away from home and their importance in the total diet. Moreover, the usefulness of the household surveys would be greatly enhanced by quantitative data on consumption away from home by family members, as well as by data on the division of the food supply among family members.

- E. Seasonality of Farm Family Diets -- Initiate research to determine the extent to which farm family diets differ with the seasons, for the interpretations of food consumption and dietary studies to nutrition education and Department programs.

Dietary surveys have usually been limited to one week, because of interview problems. Some seasonal data on which interpretations for the urban population were based were provided in 1948 surveys, but none are available for farm families. It is expected that seasonal differences in consumption of specific foods, in food expense, and in nutritive value of diets would be greater for farm than city families.

- F. Studies of Away-from-Home Eating -- Explore the desirability of cooperating in or making large-scale studies of major categories of away-from-home food operations.

A substantial part of U. S. food consumption takes place outside of family households, but relatively little information is available on the consumption patterns and marketing practices of this segment of the total food market. In the past 10 years the Department of Agriculture has made pilot studies (1) of eating places in Minneapolis and Fairmont, Minnesota, (2) of 16 selected penal, old-age, mental, children's institutions, (3) of usage of frozen foods by restaurants, and (4) a nationwide survey in 1956 of employees feeding operations of manufacturing plants. In response to a request from representatives of the Institutional Food Manufacturers Association, several AMS specialists have been advising on research of that organization into this area. Because of the growing interest in this area, consideration is being given to the formulation of specific proposals for research in several segments of the away-from-home food market both in cooperation with industry groups and unilaterally. Because this market includes all foods and a great variety of organizations, it is so broad and complex that reasonably adequate coverage will probably require the combined efforts of public and private research agencies over a period of several years. Selection and timing of research projects to be undertaken by the Department must be meshed with research plans of other agencies.

- G. Food Habits and Their Relationship to Homemakers' Knowledge of Nutrition and Attitudes about Foods -- Expand studies to investigate the cultural factors that determine food habits, including the influence of homemakers' knowledge of nutrition and the influence of attitudes and opinions about foods which may be associated with age, education, socioeconomic status (position), ethnic background, patterns of food use in homemaker's parental home, geographic region of residence, and other factors.

These studies would provide information which could be the basis for designing promotional programs and programs of education to encourage consumption of foods which are presently omitted from the diets of various family groups. The studies would make available more specific information about attitudes toward foods than generally has been available in the past and therefore should permit more effective promotional programs to be devised.

The proposed studies would consist of several stages including:
(1) an exploratory survey conducted in one moderate-sized city;
(2) a survey in one moderate-sized city; and (3) one or more surveys based on a sample of households in the United States.

- H. Consumer Discrimination Thresholds for Quality Factors in Food Products and Consumer Preferences for Food Products Differing in Quality Factors -- Initiate a series of systematic studies to determine: (1) consumer discriminable differences among specific food products varying in quality factors, (2) relationships between such quality factors and the physical characteristics of the food products, and (3) consumer preferences among products differing in quality factors.

In these studies a series of laboratory taste tests using standard methods on untrained tasters would be employed to determine what quality differences can be distinguished by consumers. These results would be related also to the physical measurements of the product samples tested. The taste tests would provide in addition certain information about consumer preferences in relation to quality factors. More comprehensive information about consumer preferences would be obtained from a representative sample of households in a selected city which would rate various qualities of a product as used in the home under normal conditions.

Research in this area is essential in establishing consumer preferences as to quality, and should be of benefit to growers and processors in producing the type of product most acceptable to consumers. The results should also be of use in establishing or modifying standards for grades.

V. RESEARCH AND EDUCATIONAL WORK ON BROAD
OR GENERAL WELFARE PROBLEMS

A. PROGRESS ON WORK UNDER WAY

1. Food Distribution Division - AMS

a. National School Lunch Program

In November (the month of peak participation during 1955-56), 9.7 million children were eating lunches with milk under this program -- a gain of 10 percent over the peak month in the preceding year. Over 2,000,000 additional children were participating in the milk-only (Type C) feature of the National School Lunch Program in 1954-55, making a total participation of nearly 11,000,000 children in that year. In 1955-56, however, milk served to children apart from the complete lunch has been consolidated under the revised Special School Milk Program.

The new guide for planning and equipping school lunchrooms is scheduled for release in September of this year. The guide contains information on location, space, construction features and equipment for all lunchroom areas and is based upon the service of lunches meeting the Type A standard. Also scheduled for release this fall is the first in a series of annual supplements to the recipe card file. This first supplement will contain 25 recipe cards, including 14 main-dish (protein) recipes.

b. Special Milk Program

The revised Special School Milk Program resulted in considerable additional expansion during the second year of program operations. Over 62,000 schools participated in the program, a more than 50 percent increase over the 41,000 schools participating in 1954-55.

Over 1,400,000,000 half-pints of milk were consumed under the program in 1955-56 and total Federal expenditures were in excess of \$45 million. In October of 1955, a special survey of milk consumption in 22 participating school systems (representing over 1,400 individual schools) was undertaken to measure the effect of the program. (See MD report in Section IV -A-f.) In October, separate servings of milk (over and above the milk served with Type A lunches) was 80 percent higher in the survey schools than in October of 1953, the school year prior to the inauguration of the program.

In April 1956, the Congress authorized a two-year extension of the program and increased the authorized annual expenditure from \$50 million to \$75 million. It also authorized the

extension of the program to nonprofit child-care centers, summer camps, settlement houses and similar nonprofit institutions devoted to the care and training of underprivileged children on a public welfare and charitable basis. Subsequently, the Congress passed legislation authorizing the extension of the program to all nonprofit camps and child-care institutions.

c. Direct Distribution

Over 2 billion pounds of surplus foods were moved into consumption channels in this country and abroad under the Department's program of Direct Distribution. This volume was about 95 percent larger than the quantity distributed in 1954-55.

Substantial gains were made in both domestic and foreign distribution.

Eligible recipients in this country received a total of 794,700,000 pounds of food, 61 percent more than in the previous fiscal year. All the categories of domestic recipients shared in the increases. Donations to schools, totaling 266,700,000 pounds, were up 36 percent. Donations to institutions were 39 percent larger, at 133,200,000 pounds. And donations to needy persons were up 96 percent to a total of 394,800,000 pounds.

Foreign donations reached a total of 1,220,500,000 pounds, 125 percent larger than in the previous fiscal year. These overseas donations are made after provision for the needs of all eligible recipients in this country. The distribution is currently being made to needy persons in 84 foreign countries through 25 private United States welfare agencies.

Foods distributed in this country went during the year to about 12,000,000 school children, and to 1,300,000 needy persons in charitable institutions. In addition, 3,500,000 needy persons in family units are currently certified by State agencies as eligible to receive commodities; however, the number of people actually receiving commodities is always somewhat below the number certified. Currently, 38 States and Alaska are taking part in the family distribution program.

2. Federal Extension Service Food and Nutrition Program

The nutrition program of the Extension Service has continued much in the same direction as reported last year to the committee. The only new extension emphasis has been on the long time program. The specialists have been asked to consider a long time look at the trends in food and nutrition and as a guide to the development of

nutrition programs. The Program Projection Report No. 3b (which will be made available to the committee) was prepared by a committee made up of members of the Federal Extension staff. It suggests the national trends in food and nutrition as they see it. It is suggested that each State prepare a Program Projection statement which considers their situation and that county program committees follow a similar plan in looking at the county food and nutrition situation and needs.

* * * * *

PROPOSALS FOR COMMITTEE CONSIDERATION

TOTAL LISTING

I. FOOD COMPOSITION IN RELATION TO NUTRITIVE VALUE

- A. Fatty Acids and Other Lipids in Foods -- Expand research to obtain more comprehensive data on fatty acids and other lipid fractions in foods.
- B. Carbohydrates in Foods -- Initiate laboratory analyses on carbohydrates in foods to replace inadequate or obsolete data likely to give erroneous results in diet planning and appraisal.
- C. Organic Acids in Foods -- Initiate laboratory analyses to determine the kinds and quantities of various organic acids in fruits and vegetables.
- D. Nutritive Value of Poultry Products -- Expand research to provide improved data on the nutritive value of poultry in forms as commonly processed for the table.

II. HUMAN NUTRITION

- A. Fat in Nutrition -- Initiate research to investigate the role of fat in human nutrition, such as the relationship of the amount and kinds of fat to metabolism of other nutrients, determination of desirable upper and lower limits of fat intake in the various nutritional situations, the physiological effect of fat artifacts arising from modern food processing, and the dietary precautions needed when different types of fat in diets are unusually high or low.
- B. Fatty Acid Requirements of Various Age Groups -- Initiate research to determine the requirements of various age groups for the long-chain "essential" fatty acids, with particular attention to adolescents, and to adults.
- C. Physiological Availability of Nutrients from Foods -- Expand research to determine the physiological availability of various nutrients from different foods, and the extent to which food processing, other food constituents and diet patterns affect their availability.
- D. Nutritional Requirements for Newer B-vitamins -- Initiate research to determine human requirements for pyridoxine, pantothenic acid, folic acid and related B-vitamins, in normal young adults.

- E. Dietary Factors Affecting Amino Acid Requirements -- Expand research on the effect of type of carbohydrate in the diet on amino acid utilization to include other components of diet, and other biochemical and physical criteria of the nutritional effects.
- F. Effect of Mineral Interrelationships in Nutrition -- Expand studies on mineral interrelationships in nutrition.

III. FOOD QUALITY AND HOUSEHOLD USE

- A. Evaluating Palatability -- Initiate research to develop and standardize more rapid, reliable, and reproducible laboratory methods and procedures for the sensory evaluation of food quality.
- B. Reference Method for Evaluating Effect of Pesticide Residues on Palatability -- Initiate research to standardize reliable procedures for inter-laboratory use in evaluating the palatability of foods, with particular reference to the effect of pesticides and other agricultural chemicals used in production.
- C. Insecticide Residues -- Expand work on insecticide residues including their toxic effects to plants, animals, and soils
- D. Food Qualities Affected by New Methods of Cooking -- Initiate studies to determine the comparative effects of new and different methods of cooking on food qualities and nutritive values.
- E. Quality and Safety of Re-Frozen Foods -- Initiate research to determine the effect of thawing and re-freezing on the quality and safety of frozen foods.
- F. Impact of Air Pollution on Food Supply -- Initiate research to determine the impact of air pollution on food supply.
- G. Prevention of Deterioration of Meat, Poultry and Eggs -- Expand research on the prevention of deterioration of fresh eggs and fresh and frozen meat and poultry to assure higher quality and reduce spoilage losses.
- H. Relation of Composition to Quality in Frozen and Refrigerated Meats -- Initiate studies on the relation of composition to quality in frozen and refrigerated meats.
- I. Prevention of Insect Infestation of Food In Marketing Channels -- Expand research on the prevention of insect infestation of food in marketing channels.

- J. Objective Measurement of Quality Factors -- Expand studies leading to the development of new or improved methods and instruments for the objective measurement of quality factors in raw and processed agricultural commodities.
- K. Composition of Fruits, Vegetables, and Their Products in Relation to Quality and Retention of Consumer Values Through Marketing and Processing -- Expand basic investigations of the composition and physical structure of fruits, vegetables, and their products.

IV. FOOD CONSUMPTION AND DIETARY LEVELS

- A. Adjusted Estimates of Nutritive Value of Food Supplies -- Initiate research to adjust estimates of nutritive value of national and family food supplies, by making deductions for food waste in consuming groups for use in Department programs and in nutrition education.
 - B. Food Composition Tables -- Expand research to increase the scope of tables of composition and nutritive value of foods.
 - C. Facts for Nutrition Programs -- Expand the series "Facts for Nutrition programs" to include research findings on food and nutrition that will be useful in nutrition programs.
 - D. Food Consumption of Family Members -- Initiate research on food consumption and nutrients content of diets of individuals to determine differences among age groups and the contribution to the total diet of foods consumed away from home.
 - E. Seasonality of Farm Family Diets -- Initiate research to determine the extent to which farm family diets differ with the seasons, for the interpretations of food consumption and dietary studies to nutrition education and Department programs.
 - F. Studies of Away-from-Home Eating -- Explore the desirability of cooperating in or making large-scale studies of major categories of away-from-home food operations.
 - G. Food Habits and Their Relationship to Homemakers' Knowledge of Nutrition and Attitudes about Foods -- Expand studies to investigate the cultural factors that determine food habits.
 - H. Consumer Discrimination Thresholds for Quality Factors in Food Products and Consumer Preferences for Food Products Differing in Quality Factors -- Initiate a series of systematic studies to determine: (1) consumer discriminable differences among specific food products varying in quality factors, (2) relationships between such quality factors and the physical characteristics of the food products, and (3) consumer preferences among products differing in quality factors.
-